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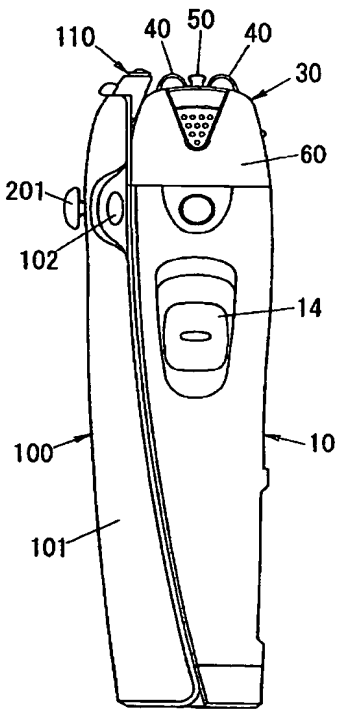
(54) Title: HAIR REMOVING DEVICE WITH A LOTION APPLICATOR



(57) Abstract: An improved hair removing device is capable of controlling a dispensing amount of the lotion to give the lotion adequately as intended by a user for comfortable hair treatment. The device includes a housing (10) carrying a hair removing head (30) adapted to be held against a user's skin for hair depilation or epilation. The device further includes an applicator (110) for dispensing the lotion on the user's skin, a tank (140) holding the lotion, and a lotion supply mechanism for supplying the lotion from the tank to the applicator. The lotion supply mechanism is provided with a regulating means (201;203;221;230) which regulates an amount of the lotion being dispensed from the applicator.

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DESCRIPTION

HAIR REMOVING DEVICE WITH A LOTION APPLICATOR

TECHNICAL FIELD

The present invention is directed to a hair removing device with a lotion applicator, and more particularly to the personal hair removing device capable of dispensing a lotion for facilitating the hair treatment as well as for making a skin care.

BACKGROUND ART

WO98/08661 and Japanese Utility Model Publication No. 59-108574 disclose a portable hair removing device capable of dispensing a lotion for facilitating the hair removal. The device incorporates a pump which is activated by a button or switch to feed the lotion over a user's skin where the hair removal is intended. The device is designed to dispense the lotion at a constant rate, which poses a problem that the lotion may be too much or too less for users of different skin characteristics or preferences.

DISCLOSURE OF THE INVENTION

In view of the above inconvenience, the present invention has been achieved to provide an improved hair removing device which is capable of controlling a dispensing amount of the lotion to give the lotion adequately as intended by a user for comfortable hair treatment. The device in accordance with the present invention includes a housing carrying a hair removing head which is adapted to be held against a user's skin for hair depilation or epilation. The device also includes an applicator which dispenses the lotion on the user's skin, a tank holding the lotion, and a lotion supply mechanism for supplying the lotion from the tank to the applicator. The lotion supply mechanism includes a regulating means which regulates an amount of the lotion being dispensed from the applicator.

Thus, the applicator is enabled to dispense the lotion in an adequate amount as preferred by the user, thereby assuring comfortable hair removing treatment.

The lotion supply mechanism includes a feed path extending from the tank to the applicator. In a preferred embodiment of the present invention, the regulator means includes a manipulator which acts on the feed path to vary the cross-sectional area of the feed path for regulating a flow rate of the lotion, i.e., the dispensing amount of the lotion.

The tank may be made of a flexible material as a collapsible bag, and the lotion supply mechanism includes a pressure means which applies a pressure to the tank for expelling the lotion out of the tank to the applicator. In this case, the regulator means may include a handle for varying the pressure applied to the tank by the pressure means. When the pressure means is designed to include more than one pressurizers, the handle is interlocked with one of the pressurizers for varying the overall pressure being applied to the tank for regulation of the dispensing amount of the lotion.

Instead of the pressure means, the device may utilize a powered pump for expelling the lotion from the tank to the applicator. In this instance, the regulating means also include a handle for varying pump capacity of the powered pump.

A diaphragm pump may be utilized as the powered pump which includes a pump chamber with a diaphragm carrying a piezoelectric element. The diaphragm is caused to deform, in response to a voltage being applied to the piezoelectric element, to develop a force of expelling the lotion out of the tank. In this instance, the regulating means includes the handle that varies the frequency at which the diaphragm repeats deforming for regulating the flow rate of the lotion being expelled to the applicator.

Instead of the powered pump, the lotion supply mechanism may include a manual pump having a pump chamber and a movable member which develops a force of expelling the lotion upon being displacement. The handle of the regulator is connected to the movable member for varying a displacement amount that the movable member is allowed to move, thereby enabling to regulate the dispensing amount of the lotion equally.

The regulating means may be additionally provided with a stop means which stops feeding the lotion from the tank to the applicator, thereby assuring another possibility of making the hair removal without the aid of the lotion.

The present invention discloses another advantageous feature of avoiding undesired leakage of the lotion from the tank when the applicator is removed together with a head frame of the hair removing head for the purpose of cleaning the hair removing unit. For this purpose, the lotion supply mechanism includes a head conduit extending integrally from the applicator and a tank conduit extending from the tank. The tank conduit is detachably connected to the head conduit for feeding the lotion from the tank to the applicator, while the head conduit is detachable together with the head frame from the housing. The lotion supply mechanism includes a stop means which, in response to the detachment of the head frame from the housing, stops feeding the lotion out the tank conduit.

The stop means may be realized by a check valve which is provided at one end of the tank conduit for closing the same. The check valve is actuated by the head conduit to open when the head conduit is moved to be connected to the tank conduit.

Alternatively, the stop means may be realized by a lock member which is positioned at one end of the tank conduit and is biased into a lock position of closing the tank conduit. The lock member is interlocked with the head frame so that it is

actuated by the head frame to move into an unlock position of opening the tank conduit as long as the head frame is kept attached to the housing.

When the powered pump is utilized for expelling the lotion from the tank to the applicator, the stop means may be in the form of a stop switch which is actuated, upon detachment of the head frame from the housing, to cease operating the pump.

Preferably, the head conduit is connected to the tank conduit outside of the hair removing unit so as to make the connection free from taking in clipped hairs which would otherwise clog the lotion feed path.

Also for avoiding undesired entry of the clipped hairs, the head conduit extends downward from the hair removing head and is formed at its lower end with a socket for receiving the upper end of the tank conduit to make an interconnection therebetween. That is, as the socket of larger diameter than that of the upper end of the tank conduit is directed with its opening facing downward, the socket does not act to collect the clipped hairs in its large opening to thereby reduce a possibility of capturing the clipped hairs.

The tank conduit may be formed with a tank connection with the tank. The tank connection is pivotally supported to the housing so as to be movable within a predetermined angular angle in relation to a nearby plane of the housing for selectively projecting outwardly of the housing. With this feature, the tank can be coupled to the tank conduit in a direction suitably angled with regard to the plane of the housing for facilitating the replacement of the tank.

It should be noted here that the above technical feature of avoiding the undesired lotion leakage from the tank conduit can alone constitute an independent subject matter of the invention without relying upon the feature of regulating the dispensing amount of the lotion

Further, the present invention discloses a unique feature of avoiding the leakage of the lotion from the tank itself prior to the tank being coupled to the tank conduit or the lotion feed path. For this purpose, the tank has a spout which is detachable to the lotion feed path and provided with a normally closed elastic valve. The elastic valve is caused to deform elastically to open for discharging the lotion to the lotion feed path only when the spout is coupled to the lotion feed path.

The elastic valve has a thick member and a thin member surrounding the thick member and giving elasticity to the valve. The thin member is supported to the spout and is provided with a vent for passing therethrough the lotion. The spout includes a socket hole of circular cross-section for detachably receiving therein a tube forming the lotion feed path. The thick member is formed into a semi-spherical shape with a rounded portion being pressed against the end of the socket hole to close the same in the absence of the tube in the socket hole. Thus, the rounded portion of the semi-spherical shaped thick member is utilized to close the spout successfully for preventing the lotion leakage.

Preferably, the tank is formed into a flat flexible bag having a reduced thickness relative to its width. In this connection, the spout is formed with restricting means adjacent to the elastic valve in order to restrict an external force being applied in the thickness direction of the bag from transmitting to and deforming the thick member. Thus, the elastic valve can be free from being caused to open even if the user pinches the bags around the elastic valve

The restricting means may comprise a pair of projections which are diametrically opposed around the end of the socket hole in alignment with the thickness direction of the bag. The projections are held in an intimate supporting contact with the thin member so as to keep the thin member free from being deformed

by the external force applied to the bag in the thickness direction.

Further, the thick member is preferably formed with a seat projection on the rounded top of the semi-spherical shaped thick member for receiving the end of the tube inserted into the socket hole. The seat projection is dimensioned to leave a gap of a gap of 0.2 mm to 3 mm between the rounded portion and the end of the tube for allowing the lotion to pass therethrough when the tube is inserted into the socket hole to push said thick member. With the use of the seat projection for abutment against the tube, the rounded portion responsible for closing the socket hole can be kept intact for assuring reliable closure of the spout.

It should be noted at this point that the above feature of preventing the lotion leakage from the tank itself can alone constitutes another subject matter without relying upon the previously-mentioned features of regulating the dispensing amount of the lotion or the features of preventing the lotion leakage upon detachment of the head frame from the housing.

Preferably, the elastic valve is made of a rubber material selected at least one from the group consisting of ethylene-propylene rubber, nitrile-butadiene rubber, and fluorinated rubber.

Further, the present invention gives another useful feature of providing an indicator for indicating the amount of the lotion remaining in the tank. When the lotion supply mechanism utilizes a pressurizer plate that moves relative to the housing in order to give a pressure to the tank for expelling the lotion to the applicator, a sensor is provided to monitor the position of the pressurizer plate to give a corresponding signal representative of the amount of the lotion remaining in the tank. In response to the signal, the indicator gives a visual indication of the remaining amount of the lotion.

Instead of using the sensor, the tank itself may be formed integrally with the indicator which is caused by the pressurizer plate to project on the exterior of the device when the pressurizer plate presses or squeeze the tank to an extent that the tank becomes nearly exhausted, thereby giving the indication of the nearly empty condition to the user for prompting the user to replace the tank.

These and still other objects and advantageous features of the present invention will become apparent from the following detailed description of the preferred embodiments of the present invention when taken in conjunction with the attached drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side view of a hair removing device in accordance with a first embodiment of the present invention;

FIG. 2 is a front view of the device;

FIG. 3 is a vertical section of the device;

FIG. 4 is a horizontal section of the device;

FIG. 5 is vertical section showing a lotion applicator included in the device;

FIG. 6 is an exploded perspective view of the applicator and its associated parts;

FIG. 7 is an exploded perspective view of the applicator;

FIGS. 8 and 9 are sectional views illustrating the lotion dispensing actions of the applicator, respectively;

FIG. 10 is a front view of the device shown with some parts removed;

FIGS. 11 and 12 are vertical sections of the device, respectively;

FIG. 13 is a vertical view of a modification of the above embodiment;

FIG. 14 is a partial section of an applicator in accordance with another modification of

the above embodiment;

FIG. 15 is a vertical section of a device in accordance with a second embodiment of the present invention;

FIG. 16 is a vertical section of a device in accordance with a third embodiment of the present invention;

FIG. 17 is a vertical section of a device in accordance with a fourth embodiment of the present invention;

FIG. 18 is a partial vertical section of a device in accordance with a fifth embodiment of the present invention;

FIG. 19 is a vertical section of a device in accordance with a sixth embodiment of the present invention;

FIGS. 20A, 20B, and 20C are diagrams showing the operation of an indicator of the above device, respectively;

FIG. 21 is a perspective view of a tank utilized in the above device;

FIG. 22 is an exploded perspective view of the tank;

FIG. 23 is a vertical section showing the connection of the tank and the applicator;

FIG. 24 is a vertical section of the tank;;

FIG. 25 is a side view of a spout of the tank;

FIG. 26 is a bottom view of the above spout;

FIG. 27 is a vertical side section of the tank;

FIG. 28 is a vertical section of a device in accordance with a seventh embodiment of the present invention;

FIG. 29 is an exploded vertical section of the above device;

FIG. 30 is an exploded perspective view of the above device;

FIGS. 31 and 32 are vertical sections showing a lotion feed path connection of the

device, respectively;

FIG. 33 is a vertical section of a hair removing head of the above device;

FIG. 34 is an exploded perspective view of an applicator of the above device;

FIGS. 35A and 35B are diagrams showing the operation of a diaphragm pump utilized in the above device;

FIGS. 36 and 37 are vertical sections of a device in accordance with an eighth embodiment of the present invention;

FIG. 38 is an exploded perspective view of a diaphragm pump utilized in a modification of the above device;

FIG. 39 is a side view of the above device;

FIGS. 40 and 41 are diagrams showing a lotion feed path connection of a device in accordance with a ninth embodiment of the present invention, respectively;

FIGS. 42 and 43 are diagrams showing a lotion feed path connection of a device in accordance with a tenth embodiment of the present invention, respectively; and

FIG. 44 is a vertical section of a device in accordance with an eleventh embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

First Embodiment <FIGS. 1 to 12>

Referring now to FIG. 1, there is shown a dry shaver as one typical version of the personal hair removing device in accordance with the first embodiment of the present invention. The shaver includes a housing **10** to be grasped by a hand of a user, a shaving head, i.e., a hair removing head **30** projecting on top of the housing, and an applicator **110** projecting adjacent to the hair removing head **30** for dispensing a lotion on a user's skin where the hair removing is made.

The hair removing head **30** is composed of three hair cutting sections, namely, a pair of short-hair cutters **40** and a long-hair cutter **50** interposed between the short-hair cutters **40**. The short-hair cutter **40** has a U-shaped outer shearing foil **41** and an inner cutter **42** which is driven to oscillate in shearing engagement with the foil, while the long-hair cutter **50** is composed of a slender outer cutter **51** and an inner cutter **52** driven to oscillate in shearing engagement with the outer cutter. The outer shearing foil **41** and the long hair cutter **50** are floatingly supported to a head frame **60** detachably supported to a base frame **62** which is held on top of the housing **10**. The housing **10** incorporates an electric motor **15** which is connected to oscillate driving elements **11** to which the inner cutters **42** and **52** are coupled. The inner cutters **42** are urged upwardly by bias springs **12** so that the short-hair cutters **40** can be depressed when pressed against a user's skin. The long-hair cutter **50** is biased by a like spring provided in the head frame **60** to be capable of being depressed relative to the top frame or the housing. A switch handle **14** is provided on one side of the housing **10** to activate the motor and therefore oscillate the inner cutters for shaving.

Provided on a front face of the housing **10** is a lotion feed module **100** which includes a front cover **101** mounting thereon the applicator **110** at a position adjacent to the short-hair cutter **40** for dispensing the lotion on the user's skin being shaved or to be shaved. The applicator **110** is supplied with the lotion from a tank **140** by means of a lotion supply mechanism which includes a pressurizer **70** for expelling the lotion out of the tank **140** and a feed path extending from the tank **140** to the applicator **110**. As shown in FIGS. 3, 6 and 7, the applicator **110** is supported to a holder **130** which is detachably supported to the front cover **101** and is capable of being separated from the front cover together with the applicator **110** and the tank **140**

also detachably supported to the holder **130**. The front cover **101** is detachably supported to the housing and is provided at its upper lateral sides with release buttons **102** for disengagement of the front cover from the housing **10**.

When the front cover **101** is attached to the housing **10**, the tank **140** is pressed by the pressurizer **70** in the form of a plate pivotally supported at its lower end to the front lower end of the housing **10**. The pressurizer **70** is urged towards the tank **140** by a set of spring devices to squeeze the tank **140** for expelling the lotion out to the applicator **110**. As shown in FIGS. 3, 6, 11, and 12, the spring devices includes a pair of vertically spaced coil springs **81** and **82** held between the pressurizer **70** and the housing **10**, and a spring loaded pusher **83** with a lever **84** in pressing contact with the pressurizer.

Referring to FIG. 7, the holder **130** is configured to movably support the applicator **110** relative to the holder in such a manner that the applicator **110** is oriented to have its top lotion dispensing end in closely adjacent relation to the short-hair cutter **40** when the applicator is held in its upper most position, as shown in FIG. 1. As the applicator **110** is depressed, it becomes closer to straight in order to avoid interfering with the short-hair cutter **40**. For this purpose, the holder **130** includes a pair of arcuate grooves **131** for slidably receiving fins **112** on opposite side of the applicator **110**. Coils springs **133** are interposed between the holder **130** and the applicator **110** to bias the applicator upwardly, i.e., floatingly support the applicator **110**, whereby the applicator **110** is permitted to follow the contour of the skin easily while the shaver is manipulated to move across the skin. As the applicator **110** is depressed against the bias of the springs **133**, the fins **112** are guided along the length of the grooves **131** to change the posture of the applicator relative to the hair removing head **30**.

As best shown in FIGS. 7, 8 and 9, the applicator **110** includes a header **111** having a chamber **113** for temporarily storing the lotion supplied from the tank **140**. In detail, the header **111** is in the form of a hollow casing with a bottom wall **114** and a top wall **118**, and includes a floating bed **120** which is vertically movable within the chamber and is floatingly supported to the bottom wall **114** by means of coil springs **121**. A plurality of rotating elements or balls **124** are loosely fitted respectively within apertures **119** formed in the top wall **118** so as to come into rolling contact with the skin when the applicator **110** is held against the skin. The apertures **119** communicate with the chamber **113** such that the lotion passes through a clearance between the aperture **119** and the ball **124** for dispensing the lotion over the skin while the balls rotate in contact with the skin. The balls **124** are supported on the floating bed **120** so as to be capable of being depressed together therewith against the bias of the springs **121**, as shown in FIG. 9, as a consequence of the applicator **110** being pressed against the skin.

Projecting downwardly from the bottom wall **114** is a sleeve **115** which communicates with the chamber **113** and is secured to one end of a flexible hose **134** leading to a conduit **135** which extends through the holder **130**, as best shown in FIG. 5. The conduit **135** projects from the holder **130** to define a plug tube **137** for detachable connection to the tank **140**. Thus, the hose **134**, the conduit **135**, and the plug tube **137** are cooperative to constitute the lotion feed path from the tank **140** to the applicator **110**.

Projecting downward from the floating bed **120** is a stem **126** which extends loosely through the sleeve **115** and is provided at its bottom with a stop valve **128** in sealing contact with a bottom open end of the sleeve **115**, whereby the lotion feed path from the tank **140** to the applicator is normally closed by the stop valve **128**, as

shown in FIG. 8. The stop valve **128** is opened only when the floating bed **120** is depressed together with the balls **124**, as shown in FIG. 9. Thus, the lotion under being pressurized in the tank **140** can be supplied to the applicator **110** in response to the balls **124** being pressed against the user's skin. In this sense, the stop valve **128** is cooperative with the pressurizer **70** to supply the lotion from the tank **140** to the applicator **110**, and the balls **124** activates to dispense the lotion from the tank **140** to the applicator **110** for applying the lotion over the skin. Due to the flexible nature, the hose **134** absorbs the resulting displacement of the applicator **110** relative to the tank **140**. It is noted in this connection, as the balls **124** is depressed or lowered together with the floating bed **120**, as shown in FIG. 9, the balls **124** are caused to rotate freely for smooth rolling contact with the skin, and therefore efficient lotion feeding over the skin. In this condition, a gap or riser channel is formed between the stem **126** and the sleeve **115** to extend into an enlarged clearance **C** between the lowered floating bed **120** and the top wall **118**, thereby dispensing the lotion on the user's skin by the action of the balls **124**. It should be noted here that since the applicator **110** is held in closely adjacent relation to the hair removing head **30**, the actuator in the form of the balls **124** can be mobilized or depressed when the hair removing head **30** comes into an operative condition for hair shaving, enabling to apply the lotion over the skin easily in association with the shaving, yet requiring no extra switching operation other than pressing the applicator against the user's skin.

Turning back to FIG. 5, the holder **130** is provided with a manipulator **201** in the form of a screw for regulating the amount of the lotion being dispensed from the applicator **110**. One end of the manipulator **201** extends through the conduit **135** of the holder **130** in threaded engagement into a threaded hole **136** in the holder **130** in order to vary the cross-section of the conduit **135** and therefore the flow rate of the

lotion passing through the lotion feed path. The other end of the manipulator **201** projects on the front cover **101** to be accessible by the fingers of the user so that the user can regulate the dispensing amount of the lotion by advancing or retracting the manipulator **201**. When advancing the manipulator **201** to its maximum extent, it closes the conduit **135** to stop feeding the lotion towards the applicator **110**. Thus, the manipulator **201** constitutes a regulating means for regulating the dispensing amount of the lotion from the applicator. Also seen in FIG. 5, the conduit **135** and the hose **134** are provided respectively with a pipe **138** and a rubber core **139** in order to reduce the internal volume of the lotion feed path or minimize the amount of the lotion remaining in the lotion feed path when the tank is detached from the holder **130**, thereby minimizing the leakage amount of the lotion from the lotion feed path upon detachment of the tank **140**.

As shown in FIG. 4, the pressurizer **70** is shaped to have its surface conforming to the inner rounded surface of the front cover **101** for squeezing the flexible tank **140** to a maximum extent. Further, as shown in FIG. 10, the pressurizer **70** may be formed to have a wider width than that of the tank for the same purpose. When the tank **140** is squeezed from a fully-filled condition of FIG. 11 to a nearly empty condition of FIG. 12, projections **73** at the upper end of the pressurizer **70** abut against stoppers **13** integrally extending from the housing **10**. One of the stoppers **13** is provided with a sensor switch **18** which is actuated by the projection **73** to close an electric circuit incorporated in the housing for energizing a light emitting diode (LED) **90** located at the lower end of the housing **10**. The LED **90** is viewed through a corresponding window **103** at the lower end of the cover such that the LED acts as an indicator to inform the user of the empty condition of the tank, prompting the user to replace the tank.

Although the above embodiment illustrates the shaver as one typical example of the hair removing device, the present invention can be equally applied to a hair epilating device, as shown in FIG. 13, which includes a hair epilating head **30** provided with a cylinder **32** carrying hair pinching blades **33**. The cylinder **32** is driven by the incorporated motor to rotate about a horizontal axis, during which the pinching blades **33** are caused to open and close repeatedly to thereby pinch the hair and pluck it from the user's skin.

Further, in the above embodiment, the manipulator **201** is shown to be coupled to the holder **130**, the manipulator **201** may be coupled to the applicator **110** itself for varying the cross-section of the lotion feed path immediately upstream of the applicator, as shown in FIG. 14.

Second Embodiment <FIG. 15>

FIG. 15 illustrates a second embodiment of the present invention in which the pressurizer **70** is made to vary its pressing force to the tank **140** for regulating the dispensing amount of the lotion. The other structures and the functions are identical to the first embodiment so that no duplicate explanation is made here and like parts are designated by like reference numerals. In this embodiment, the spring-loaded pusher **83** urging the pressurizer **70** is cooperative with a handle **203** to constitute a regulating means or system for regulating the dispensing amount of the lotion. As shown in FIGS. 6 and 15, the pusher **83** comprises a pair of coil springs **85** fitted respectively around vertical rods **86** secured to the housing **10**, and a pair of sliders **87** connected to the upper end of the coil springs **85**. The sliders **87** are slidable along the length of the respective rods **86** and are each provided with a pivot arm **88** having one end pivotally connected to the slider and the other end pivotally connected to the lever **84**. The lever **84** has its upper ends pivotally supported to the housing

10 so that lever 84 is urged towards away from the housing by the action of the coil springs 85 for giving to the pressurizer 70 the force of pressurizing the tank 140. It is these coil springs 85 that are adjusted to vary the pressing force of the pressurizer 70 for regulating the dispensing amount of the lotion. The handle 203 has its inner ends 204 slidably fitted around the rods 86 in supporting relation respectively with the lower ends of the coil springs 85 so as to adjust the compressing force of the springs by moving the handle vertically. For this purpose, the handle 203 is provided with an adjustor knob 205 exposed on the exterior of the front cover 101 to be accessible by the user's hand. The handle 203 is normally biased to a lowermost position by the coil springs 85 and is manipulated to temporarily move upwardly against the bias of the coils springs 85 as the user wishes to increase the dispensing amount of the lotion. Alternatively, the handle 203 may be clicked into any desired position by means of a detent mechanism or the like for retaining the handle or keeping the intended dispensing amount of the lotion.

Third Embodiment <FIG. 16>

FIG. 16 illustrates a third embodiment of the present invention in which the tank 140 receives an additional pressing force by a manual compressor 210 which constitutes a regulating system for regulating the dispensing amount of the liquid from the applicator 110. The other structures and the functions are identical to the first embodiment so that no duplicate explanation is made here and like parts are designated by like reference numerals. The compressor 210 comprises a frame 211 secured to the front cover 101 and carrying a handle 212 with a knob 213, a pad 214, and a spring 215 urging the handle 212 away from tank 140. The pad 214 extends through the front cover 101 to come into pressing contact with the tank 140 to give an

additional pressure for squeezing the tank **140** independently of the pressurizer **70**. Thus, the manual compressor **210** develops the squeezing force that varies with the pressing force applied to the knob **213** by the user, thereby enabling to regulate the dispensing amount of the liquid from the applicator **110**.

Fourth Embodiment <FIG. 17>

FIG. 17 illustrates a fourth embodiment of the present invention in which a powered pump **220** is utilized to expel the lotion from the tank to the applicator **110** and a switch handle **221** which varies pump capacity of the pump for regulating the dispensing amount of the lotion from the applicator. The other structures and the functions are identical to the first embodiment so that no duplicate explanation is made here and like parts are designated by like reference numerals. The pump **220** is powered by an electric motor **222** of which power is adjusted by the switch handle **221** mounted on the exterior of the front cover **101** and accessible by the user. The pump **220** has its inlet connected to a flexible conduit **135** detachable to the tank **140** and has its outlet connected to the applicator by means of a flexible hose **134**. The switch handle **221** has an additional stop position of ceasing the pump **220** and therefore disabling the applicator from dispensing the lotion.

Fifth Embodiment <FIG. 18>

FIG. 18 illustrates a fifth embodiment of the present invention in which a manual diaphragm pump **230** is included in the lotion feed path extending from the holder **130** to the applicator **110** for regulating the dispensing amount of the lotion from the applicator. The other structures and the functions are identical to the first embodiment so that no duplicate explanation is made here and like parts are designated by like reference numerals. The diaphragm pump **230** has a pump

chamber **231** and a diaphragm **232** varying the volume of the chamber. The pump chamber **231** is provided midway in the hose **134** between the holder **130** and the applicator **110**, and includes inlet valve **233** for allowing the lotion to be sucked into the chamber from the tank through the conduit **135**, and an outlet valve **234** for allowing the lotion to be expelled from the chamber to the applicator. Associated with the pump **230** is a manipulator **235** in the form of a screw that is supported to the front cover **101** to be movable in the axial direction, and is biased by a spring **236** to move away from the diaphragm **232**. A knob **238** is formed at one end of the manipulator **235** and projects out of a frame **237** attaching the manipulator **235** to the front cover **101** to be accessible by the finger of the user. The diaphragm **232** is actuated manually to introduce the lotion into the chamber by pressing the knob **238** and to pump the lotion out of the chamber to the applicator **110** by releasing the knob. In other words, the pump gives an additional pressure for feeding the lotion to the applicator and therefore dispensing the lotion from the applicator. Thus, it is readily possible to vary the dispensing amount of the lotion by manually activating the diaphragm pump. It is noted in this connection, the manual pump can be alone provided or in combination with the pressurizer **70** as discussed hereinbefore for feeding the lotion from the tank to the applicator, i.e., supplying the pressurized lotion to the applicator **110**. Further, the manipulator **235** is provided with an adjustor dial **238** or nut for adjusting a projecting amount of the manipulator towards the diaphragm **232** and therefore a deforming amount of the diaphragm to adjust the flow rate of the lotion being fed to the applicator **110**, or the pump capacity per one pushing of the manipulator. The adjustor dial **238** may be moved to a stop position where the manipulator cannot reach the diaphragm for disabling the diaphragm pump.

Sixth Embodiment <FIGS. 19 and 20>

FIGS. 19 and 20 illustrate a sixth embodiment of the present invention which is identical to the first embodiment except that a mechanical indicator **144** is carried on the tank for indication of the amount of the lotion remaining in the tank **140**. The other structures and operations are identical to the first embodiment. Therefore, no duplicate explanation is made herein and like parts are designated by like reference numerals. The tank **140** is provided with the indicator **144** which is made of an elastic material and shaped into a bowl with a center stud **146**. As shown in FIG. 20, the bowl has its brim **145** sealed around a hole **142** in the tank **140** with the center stud **146** located in the center of the hole **142** which is in direct communication with a window **107** in the front cover **101**. At the fully-filled condition of the tank **140** (FIG. 20A), the bottom of the indicator **144** is spaced from the opposite wall of the tank to locate the stud **146** not projecting into the window **107**. As the tank **140** is squeezed from its half-empty condition to a nearly empty condition by the action of the pressurizer **70**, the indicator **144** is pushed by the pressurizer to advance the distal end of the stud **146** from a mid-position within the window **107** (FIG. 20B) to a projected position on the exterior of the front cover **101** (FIG. 20C). Thus, the indicator **144** gives a clear indication of the amount of the lotion remaining in the tank.

Now referring to FIGS. 21 to 24, the tank **140**, which is made of the flexible material into a collapsible bag having a reduced thickness relative to its width, is provided with a spout **150** detachable to the lotion feed path, i.e., the plug tube **137** extending from the holder **130**. The spout **150** is heat-sealed to the upper end of the tank **140** and has a socket hole **151** for selectively receiving the plug tube **137** and a cap **152**. Projecting on the lower end of the spout **150** is a barrel **154** which carries a check valve **160** for allowing the lotion to be supplied to the applicator only when the plug tube **137** is inserted into the spout **150**. As shown in FIG. 23, the holder **130** is

provided on its lower end with a pair of hooks **132** which are detachably engaged with corresponding slots **153** in the upper end of the spout **150**. When the holder **130** is coupled to the spout **150**, the plug tube **137** extends through the socket hole **151** and pushes the check valve **160** to open it for allowing the lotion to be discharged through a gap between the valve **160** and the lower end of the plug tube **137**.

The check valve **160** is made of a rubber in the form of a bottom-closed cylinder with a semi-spherical bulge **161** on the center of the bottom and a thin circular side wall **168** upstanding from a thin periphery of the bottom for engagement with a recess **155** in the barrel **154** of the spout **150**. The check valve **160** is shaped into a thin structure other than at the semi-spherical bulge **161** to be given elastic deformability such that the semi-spherical bulge **161** has its rounded portion normally kept in sealing contact with the lower end of the barrel **154** for closing the spout, as shown in FIG. 24. When the plug tube **137** is inserted into the spout **150**, the semi-spherical bulge **161** is pushed thereby to move away from the lower end of the barrel **154** for opening the spout, as shown in FIG. 23. The check valve **160** is formed in the bottom around the bulge **161** with apertures **162** for introducing the lotion from within the tank **140**. The semi-spherical bulge **161** is formed at its apex with a cross-shaped seat projection **163** which is responsible for bearing the lower end of the plug tube **137** inserted into the socket hole **151** while leaving the gap therebetween for passing the lotion into the plug tube **137**. The gap, which is left between the rounded portion of the semi-spherical bulge **161** and the lower end of the plug tube **137**, ranges from 0.2 mm to 3 mm for smoothly passing the lotion therethrough. The valve **160** is preferably made of an elastic rubber selected at least one from the group consisting of ethylene-propylene rubber, nitrile-butadiene rubber, and fluorinated rubber. These materials exhibit less permeability to alcohol

preferably contained in the lotion to prevent evaporation of the lotion from within the tank.

As shown in FIGS. 25 to 27, the barrel **154** is formed at its lower end circumference with a pair of restrictors **156** in the form of projections for preventing accidental deformation of the valve **160** leading to unintended opening. The restrictors **156** are provided at diametrically opposed portions in alignment with the thickness direction of the tank **140** so as to back-up the thin side wall **168** of the valve **160** for preventing an external force from applying to the side wall, as shown in FIG. 27. The external force is likely to be applied in the thickness direction of the tank **140** while the user holds the tank **140** of thin configuration. The lower end of the barrel other than the restrictors **156** are inclined for facilitating the side wall **168** of the valve **160** to give sufficient elastic deformation to the valve for closing and opening the end of the barrel **154**.

Seventh Embodiment <FIGS. 28 to 35>

FIGS. 28 to 35 illustrate a seventh embodiment of the present invention which is basically identical to the first embodiment except that an applicator **110A** is incorporated into a hair removing head **30A** and is detachable together with a head frame **60A** from a housing **10A**. The other structures and operations are identical to the first embodiment. Therefore, no duplicate explanation is made herein and like parts are designated by like reference numerals with a suffix letter of "A". The applicator **110A** is mounted on the head frame **60A** to be located adjacent the long-hair cutter **50A**. The head frame **60A** carries a head conduit **64** extending integrally from the applicator **110A** and projecting outwardly of the head frame **60A** for detachable connection with a tank conduit **170** which extends from the tank **140A** and

is mounted on the side of the lotion feed module **100A** attached to the housing **10A**. A diaphragm pump **330** is provided in the course of the tank conduit **170** to draw the lotion from within the tank **140A**. The lotion feed module **100A** includes the front cover **101A** and a motor **340** for the diaphragm pump **330** in addition to the tank conduit **170**. In this embodiment, the lotion supply mechanism includes the pump **330**, and the lotion feed path defined by the tank conduit **170** and the head conduit **64**. The tank conduit **170** is composed of a pump inlet tube **171** connecting the tank **140A** to the pump **330**, a pump outlet tube **172** extending from the pump, and a coupling tube **173** integrally extending from the pump outlet tube **172** for detachable connection with the head conduit **64**. The coupling tube **173** is provided at its lower end away from the connection to the head conduit **64** with a check valve **180** which is identical to the check valve **160** utilized in the spout **150** of the tank **140** as explained in detail with reference to FIGS. 22 to 27. That is, the check valve **180** is caused to open the lotion feed path upon the head conduit **64** being inserted into the coupling tube **173** for feeding the lotion to the applicator **110A**, as shown in FIG. 31. Otherwise, the coupling tube **173**, i.e., the tank conduit **170** is kept closed for preventing the lotion leaking from the tank **140** after the applicator **110A** is detached from the housing **10A** together with the head frame **60A**, as shown in FIG. 32.

As shown in FIGS. 33 and 34, the applicator **110A** of the present embodiment comprises a skin guide **120A** as one modification of the floating bed **120** depicted in the first embodiment. The skin guide **120A** is made of an elastic material and has its top end projecting on top of the header **111A** for contact with the user's skin and has its bottom spaced from the bottom of the header **111A** to define therebetween a like chamber **113A** for temporarily storing the lotion supplied from the tank. The skin guide **120A** is vertically movable between a pair of plates **117** forming the header

111A, and is urged upwardly by means of springs **121A**. Lotion dispensing gaps are defined between recesses **127** in the skin guide and corresponding stops **129** at the upper end of the header **111A** and are caused to open for dispensing the lotion as the skin guide **120A** is depressed.

The header **111A** has a sleeve **115A** for connection with the head conduit **64** to be supplied with the lotion. A stem **126A**, which projects from the lower end of the skin guide **120A** and extends into the sleeve **115A**, is formed at its lower end with a stop **128A** which normally closes the sleeve **115A** and opens as the skin guide **120A** is depressed. Thus, the lotion is dispensed only when the skin guide **120A** is pressed against the user's skin.

As shown in FIGS. 35A and 35B, the diaphragm pump **330** has a pump chamber **331** with a diaphragm **332** which is driven by the motor **340** to vary the volume of the chamber, thereby drawing the lotion through an inlet valve **333** in the chamber **331** and expelling the lotion through an outlet valve **334** to the applicator. For this purpose, a cam and crank combination **342** is provided for translating the rotational movement of the motor into a reciprocating movement of the diaphragm **332**. A controller with an adjuster handle (not shown) is provided for controlling the rotational speed of the motor **340** so that the user can regulate the dispensing amount of the lotion from the applicator as is made in the previous embodiment. Thus, the controller and the motor constitutes the regulating means for regulation of the dispensing amount of the lotion. Further, the adjustor has a stop position of ceasing the pump to disable the applicator from dispensing the lotion.

Eighth Embodiment <FIGS. 36 and 37>

FIGS. 36 and 37 illustrate an eighth embodiment of the present invention which

is similar to the seventh embodiment except that the tank conduit **170** is configured to have its one end capable of being pivoted for facilitating the attachment and detachment of the tank to the tank conduit. The other structures and operations are identical to the seventh embodiment. Therefore, no duplicate explanation is made herein and like parts are designated by like reference numerals. The pump inlet tube **171**, a part of the tank conduit **170**, is additionally provided with a tank plug **175** for detachable insertion into the spout **150A** of the tank **140A**. The tank plug **175** has its one end connected to the pump inlet tube **171** and also pivotally supported to a bracket **176** on the housing **10A** so that the tank plug **175** can be angled relative to a plane of the housing **10A**. The bracket **176** includes a spring **177** for urging the tank plug **175** to project at a large angle with respect to the plane of the housing **10A**, as shown in FIG. 36. In this connection, the front cover **101A** is divided into an upper cover **105** and a lower cover **106** detachable to the upper cover **105**. The upper cover **105** is secured to the housing **10A** to conceal therebehind the pump **330** and the major portion of the tank conduit **170**, while the lower cover **106** is detachable to the housing **10A** to conceal therebehind the tank **140A**. When the lower cover **106** is detached from the housing **10A** for replacement of the tank **140A**, the tank plug **175** pops up to project at the large angle relative to the plane of the housing **10A**. Whereby, the tank can be easy to be connected to or disconnected from the tank plug **175**, as shown in FIG. 36. The tank plug **175** after being connected to the tank **140** is folded on the housing **10A** against the spring bias as a consequence of that the lower cover **106** is attached to the housing **10A** to hold the tank therebetween, as shown in FIG. 37.

FIG. 38 illustrates another diaphragm pump **430** which may be utilized in the present embodiment. The pump is actuated by a piezoelectric actuator **439** in the

form of a film or disk incorporated in a diaphragm **432** and receiving a driving voltage from a control circuit through lines **436**. The diaphragm **432** is placed on a pump case **435** to define therebetween a pump chamber **431**. A cover **437** is secured on the pump case **435** to hold the circumference of the diaphragm **432** between the cover **437** and the pump case with the use of sealing rings **438**. Attached to the bottom of the pump case **435** is a valve assembly **450** which includes an inlet valve **433** for drawing in the lotion from the tank and an outlet valve **434** for expelling the lotion to the applicator. As shown in FIG. 39, the housing **10A** is provided on its side with a handle **440** which actuates the control circuit to apply the voltage at varying frequencies for regulating the flow rate of the lotion or the amount of the lotion being discharged from the pump. Thus, the control circuit with the handle defines a regulating means for regulating the dispensing amount of the lotion, so that user can adjust the dispensing amount of the lotion from the applicator. Also, the handle **440** has a stop position of ceasing the pump to disable the applicator from dispensing the lotion.

Ninth Embodiment <FIGS. 40 and 41>

FIGS. 40 and 41 illustrate a ninth embodiment of the present invention which is similar to the seventh embodiment except that a lock member **250** is introduced instead of the check valve **180** to stop the leakage of the lotion from the tank conduit **170** upon detachment of the applicator. The other structures and operations are identical to the seventh embodiment. Therefore, like parts are designated by like reference numerals. The lock member **250** is pivotally supported to a mounting plate **20** which is fixed to the housing **10A** and through which the upper end of the tank conduit **170** extends for detachable connection with the head conduit **64**. The lock member **250** is formed at its one end with a stop valve **251** which extends into the

tank conduit **170** for closing and opening a constricted passage **178**. The other end of the lock member **250** defines an actuator **252** which is engageable with a limb **66** integrally extending from the head frame **60A**. The lock member **250** is urged by a spring **254** to pivot in a direction of closing the passage **178** by the stop valve **251**. While the head frame **60A** is attached to the housing **10A** to mount the applicator thereon, the limb **66** pushes the actuator **252** so as to pivot the lock member **250** in a direction of opening the passage **178**, as shown in FIG. 40, thereby allowing the lotion to be supplied to the applicator. Upon detachment of the head frame **60A** from the housing **10A**, on the other hand, the lock member **250** is released and is caused by the spring **254** to move the stop valve **251** for closing the passage **178**. Thus, the lotion can be prevented from leaking out of the tank each time the head frame **60A** is detached together with the applicator.

Tenth Embodiment <FIGS. 42 and 43>

FIGS. 42 and 43 illustrate a tenth embodiment of the present invention which is similar to the ninth embodiment except that a lock member **260** acts to deform a pump outlet tube **172** made of a flexible material to define a part of the tank conduit **170**. The other structures and operations are identical to the seventh embodiment. Therefore, like parts are designated by like reference numerals. The pump outlet tube **172** is provided at its upper end with a ferrule **179** which is fixed to the mounting plate **20** for detachably connection to the head conduit **64** extending from the applicator. The lock member **260** is pivotally supported to the mounting plate **20** to be movable between a close position of closing the tank conduit **170** and an open condition of opening the tank conduit. For this purpose, the lock member **260** is formed at its end with a hook **261** engageable with the pump outlet tube **172**, and is urged by a spring **264** to the close position. The other end of the lock member **260**

defines an actuator **262** which is engageable with the limb **66** of the head frame **60A** for interlocking the lock member **260** with the head frame **60A**. While the head frame **60A** is attached together with the applicator to the housing, the limb **66** pushes the actuator **252** to thereby pivot the lock member **260** into the open position where the hook **261** disengages from the pump outlet tube **172** to keep the lotion feed path open, as shown in FIG. 42. Upon detachment of the head frame **60A**, on the other hand, the actuator **262** is released so that the lock member **260** returns to the close position where the hook **261** forcibly squeezes the pump outlet tube **172** to close the lotion feed path, as shown in FIG. 43. Thus, it is equally possible to shut the tank conduit **170** in response to the detachment of the head frame **60A** from the housing for successfully preventing the leakage of the lotion from the tank conduit.

It is noted in this connection that the head conduit **64** is formed with a socket **65** which receives the upper end of the ferrule **179** for detachable connection therebetween. The socket **65** is located to have its socket hole facing downwards so as not to collect the clipped hairs dropping from the hear removing head upon detachment of the head frame **60A** from the housing.

Further, the above lotion leakage prevention scheme by use of the lock members **250** or **260** is illustrated as related to the seventh embodiment in which the diaphragm pump **330** is responsible for feeding the pressurized lotion from the tank **140A** through the tank conduit **170** to the applicator **110A**. However, the lotion leakage prevention scheme may be equally utilized in the first embodiment in which the pressurizer **70** is responsible for feeding the pressurized lotion to the applicator.

Eleventh Embodiment <FIG. 44>

FIG. 44 illustrates an eleventh embodiment of the present invention which is

similar to the seventh embodiment except that a switch **270** is provided to stop operating the diaphragm pump **330** in response to the detachment of the head frame **60A** from the housing **10A**. The other structures and operations are identical to the seventh embodiment. Therefore, like parts are designated by like reference numerals. The switch **270** is mounted on the housing **10A** in an engageable relation with the head frame **60A** and is actuated by the head frame attached to the housing in order to enable the pump **330** for feeding the pressurized lotion to the applicator. Upon removal of the head frame **60A**, the switch **270** is released to disable the pump, thereby preventing the lotion from being discharged out of the tank conduit **170**.

The hair removing device as illustrated with reference to the embodiments of FIGS. 28 to 44 only show the shaver head as one typical hair removing head, however, the features disclosed with reference to FIGS. 28 to 44 are also applicable to the hair removing device including the epilation head as shown in FIG. 13 or any other hair removing head.

CLAIMS:

1. A hair removing device with a lotion applicator, said device comprising:

a housing;

a hair removing head mounted to said housing and adapted to be held against a user's skin for hair depilation or hair epilation,

an applicator which dispenses a lotion on the user's skin;

a tank holding the lotion;

a lotion supply mechanism for supplying said lotion from said tank to said applicator,

wherein said lotion supply mechanism includes a regulating means which regulates an amount of said lotion being dispensed from said applicator.

2. The device as set forth in claim 1, wherein

said lotion supply mechanism includes a feed path extending from said tank to said applicator, said regulating means comprising a manipulator which varies a cross-section area of said feed path.

3. The device as set forth in claim 1, wherein

said tank is made of a flexible material, and said lotion supply mechanism comprises pressure means which applies a pressure to said tank for expelling the lotion out of said tank towards said applicator,

said regulating means comprising a handle for varying the pressure applied to said

tank.

4. The device as set forth in claim 3, wherein

said pressure means includes more than one pressurizers,

said handle being interlocked with one of said pressurizers.

5. The device as set forth in claim 1, wherein

said lotion supply mechanism includes a powered pump for expelling the lotion from said tank to said applicator,

said regulating means including a handle for varying pump capacity of said powered pump.

6. The device as set forth in claim 1, wherein

said lotion supply means includes a diaphragm pump for expelling the lotion from said tank to said applicator,

said diaphragm pump having a pump chamber with a diaphragm carrying a piezoelectric element which deforms, in response to a voltage being applied to said piezoelectric element, to develop a force of feeding the lotion,

said regulating means including a handle for varying the frequency at which said diaphragm repeats deforming to regulate a flow rate of said lotion being fed to said applicator.

7. The device as set forth in claim 1, wherein

said lotion supply mechanism includes a manual pump for expelling the lotion from said tank to said applicator, said manual pump having a pump chamber with a movable member which develops a force of expelling the lotion upon being displaced,

said regulating means including a handle for varying a displacement amount that said movable member is allowed to move.

8. The device as set forth in claim 1, wherein

said regulating means additionally includes a stop means which stops feeding the lotion from said tank to said applicator.

9. The device as set forth in claim 1, wherein

said applicator is incorporated into a head frame forming a part of said hair removing head, said head frame being detachable from said housing,

said lotion supply mechanism including a head conduit extending integrally from said applicator and a tank conduit extending from said tank,

said tank conduit being detachably connected to said head conduit for feeding said lotion from said tank to said applicator, said head conduit being detachable together with said head frame from said housing,

said lotion supply means further including a stop means which, in response to the detachment of said head frame from said housing, stops feeding the lotion out of

said tank conduit.

10. The device as set forth in claim 9, wherein

said stop means is in the form of a check valve provided at one end of said tank conduit for closing the tank conduit, said check valve being actuated by said head conduit to open when said head conduit is connected to said tank conduit.

11. The device as set forth in claim 9, wherein

said stop means is a lock member which is positioned at one end of said tank conduit and which is biased into a lock position of closing the tank conduit, said lock member being actuated by said head frame to move into an unlock position of opening said tank conduit as long as said head frame is kept attached to said housing.

12. The device as set forth in claim 9, wherein

said lotion supply means includes a powered pump for expelling the lotion from said tank to said applicator through said tank conduit and said head conduit,

said stop means including a stop switch which is actuated, upon detachment of said head frame from said housing, to cease operating said pump.

13. The device as set forth in claim 9, wherein

said head conduit is connected to said tank conduit outside of said hair removing head.

14. The device as set forth in claim 9, wherein

said head conduit extends downward from said hair removing unit and is formed at its lower end with a socket for receiving therein the upper end of said tank conduit to make an interconnection therebetween.

15. The device as set forth in claim 9, wherein

said tank conduit is formed with a tank connection for detachable connection with said tank, said tank connection being pivotally supported to said housing so as to be movable within a predetermined angular range in relation to a nearby plane of said housing for selectively projecting outwardly from said housing.

16. The device as set forth in claim 9, wherein

said applicator includes a stop valve which normally closes to stop dispensing the lotion, said stop valve being made open only upon said applicator being pressed against the user's skin for dispensing the lotion.

17. The device as set forth in claim 1, wherein

said tank has a spout detachably coupled to a lotion feeding path leading to said

applicator,

said spout being provided with a normally closed elastic valve, said elastic valve being caused to elastically deform to open for discharging said lotion to said lotion feeding path when said spout is coupled to said lotion feeding path.

18. The device as set forth in claim 17, wherein

said elastic valve has a thick member and a thin member surrounding said thick member and giving elasticity to said valve, said thin member being supported to said spout and provided with apertures for passing the lotion therethrough.

19. The device as set forth in claim 18, wherein

said spout includes a socket hole of circular cross-section for detachably receiving therein a tube forming said lotion feeding path,

said thick member being formed into a semi-spherical shape with a rounded portion being pressed against the end of said socket hole to close the same in the absence of said tube in said socket hole.

20. The device as set forth in claim 18, wherein

said tank is formed into a flat flexible bag having a reduced thickness relative to its width,

said spout being formed with restricting means adjacent to a connection to said elastic valve, said restrictor means restricting an external force being applied in the

thickness direction of said bag from transmitting to and deforming said thick member.

21. The device as set forth in claim 20, wherein
said restricting means comprises a pair of projections which are held in an intimate contact with said thin member, said projections being diametrically opposed around the end of said socket hole in alignment with the thickness direction of said bag.

22. The device as set forth in claim 19, wherein
said thick member is formed with a seat projection on the rounded top of said semi-spherical shape for receiving the end of said tube inserted into said socket hole, said seat projection being dimensioned to leave a gap of 0.2 mm to 3 mm between said rounded portion and the end of said tube for allowing the lotion to pass therethrough when said tube is inserted into said socket hole to push said thick member.

23. The device as set forth in claim 17, wherein
said elastic valve is made of a rubber material selected at least one from the group consisting of ethylene-propylene rubber, nitrile-butadiene rubber, and fluorinated rubber.

24. The device as set forth in claim 1, wherein

an indicator is provided to indicate an amount of the liquid remaining in said tank.

25. The device as set forth in claim 24, wherein

said tank is made of a flexible material and said lotion supply mechanism includes a pressurizer plate which moves relative to said housing to give a pressure to said flexible tank for expelling the lotion to said applicator,

a sensor being provided to monitor the position of said pressurizer plate to give a corresponding signal as representative of an amount of the lotion remaining in the tank,

said indicator being responsive to said signal to indicate the amount of the lotion remaining in said tank.

26. The device as set forth in claim 25, wherein

said indicator gives visual information indicative of the amount of the lotion remaining in the tank.

27. The device as set forth in claim 25, wherein

said tank is made of a flexible material and said lotion supply mechanism includes a pressurizer plate which moves relative to said housing to give a pressure to said flexible tank for feeding the lotion to said applicator,

said tank being formed integrally with said indicator which is caused by said

pressurizer plate to project on the exterior of said device when said pressurizer plate presses the tank to an extent that the tank becomes nearly exhausted, thereby indicating that condition.

FIG. 1

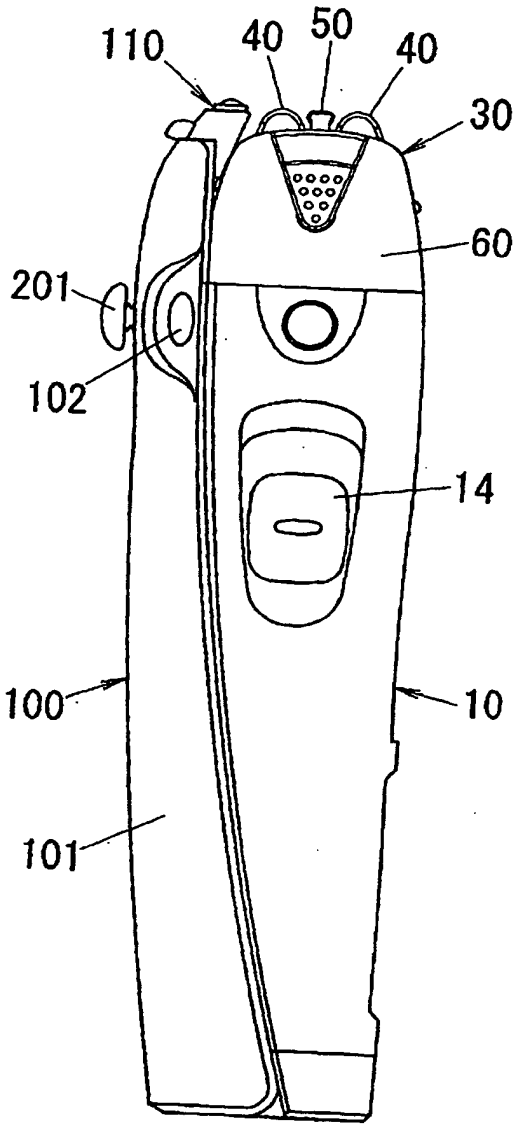

FIG. 2

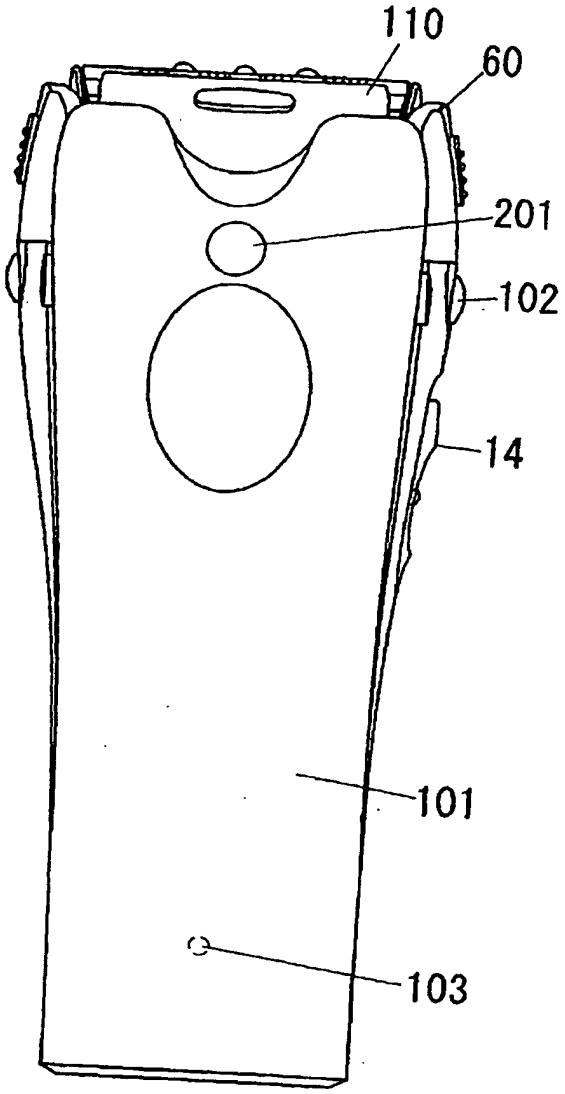

FIG. 3

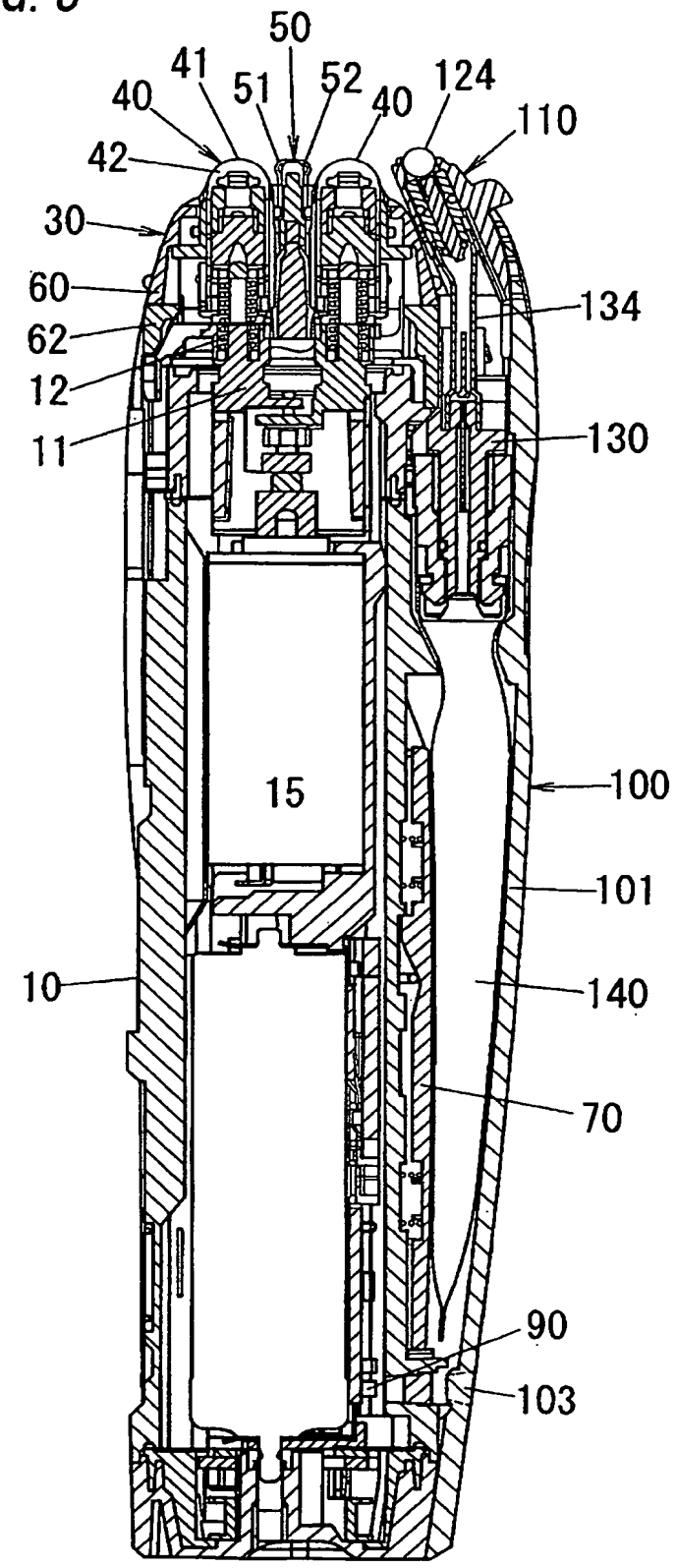
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FIG. 4

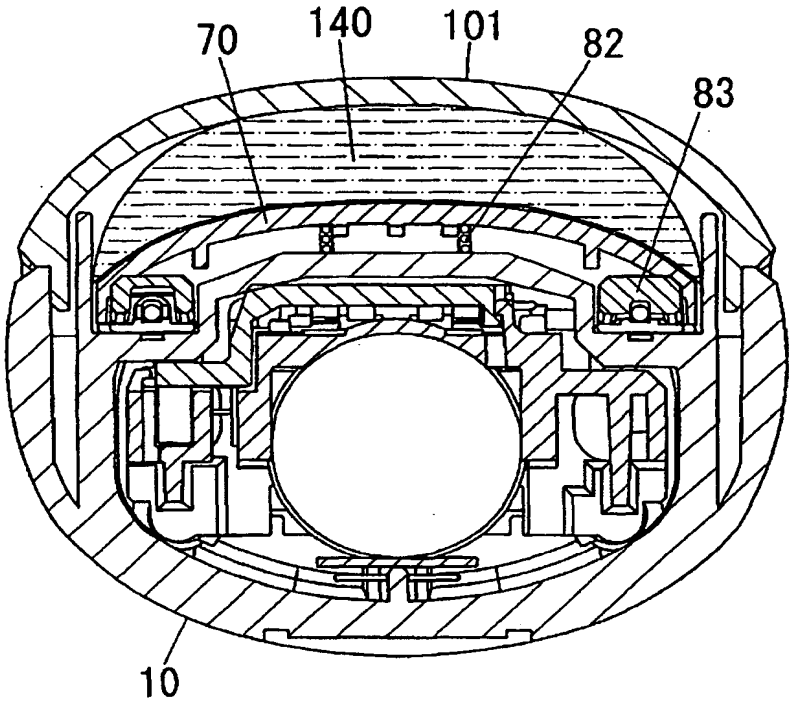


FIG. 5

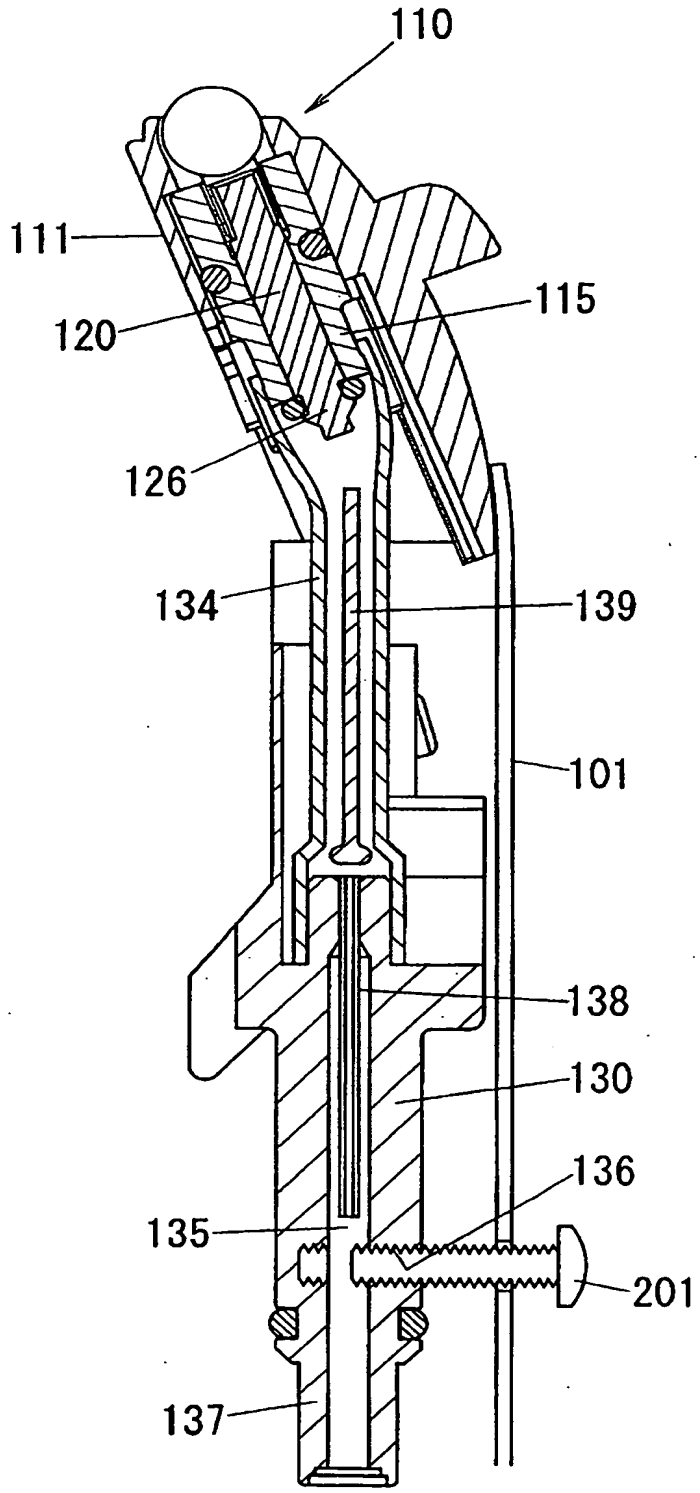
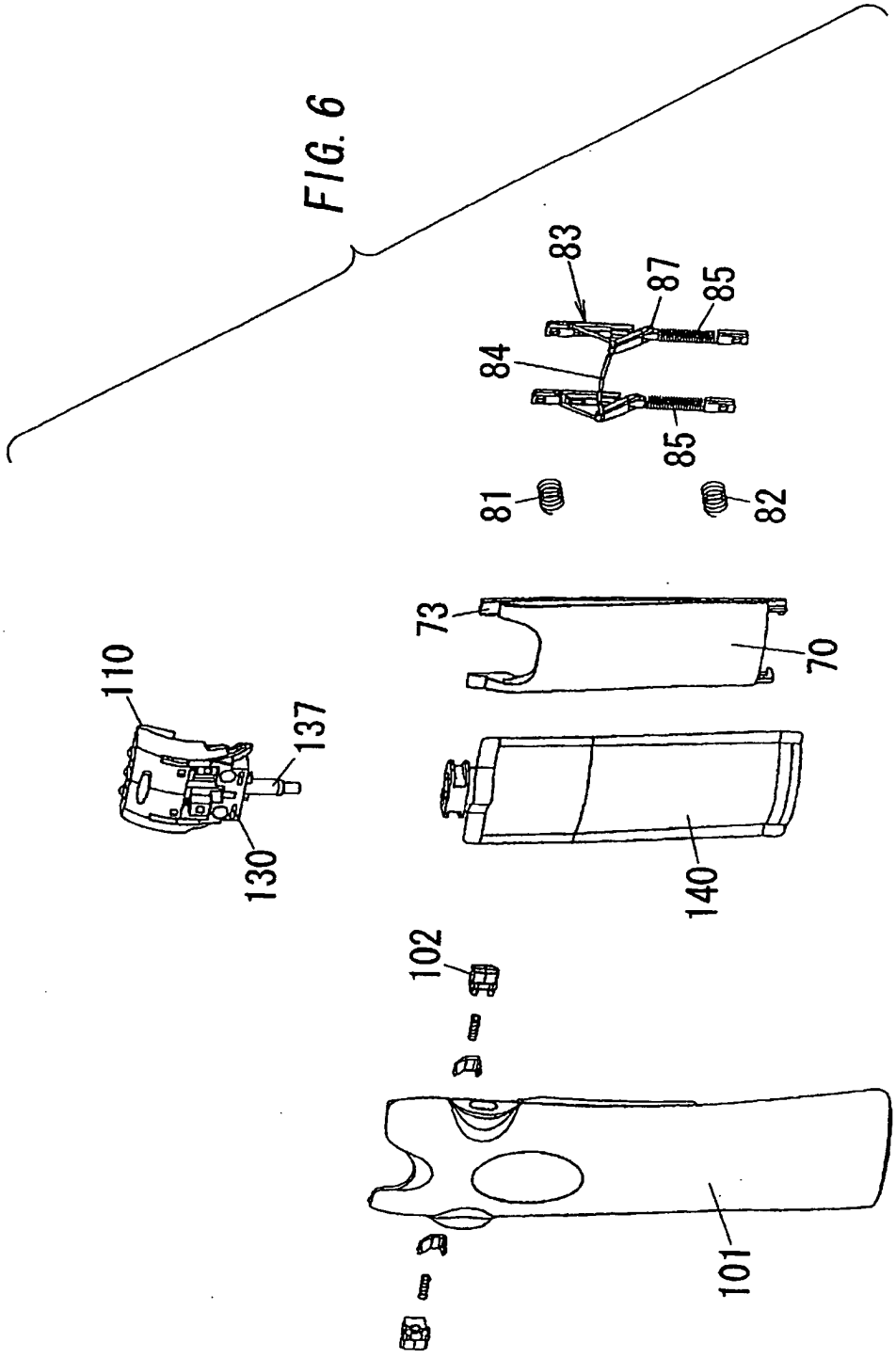


FIG. 6



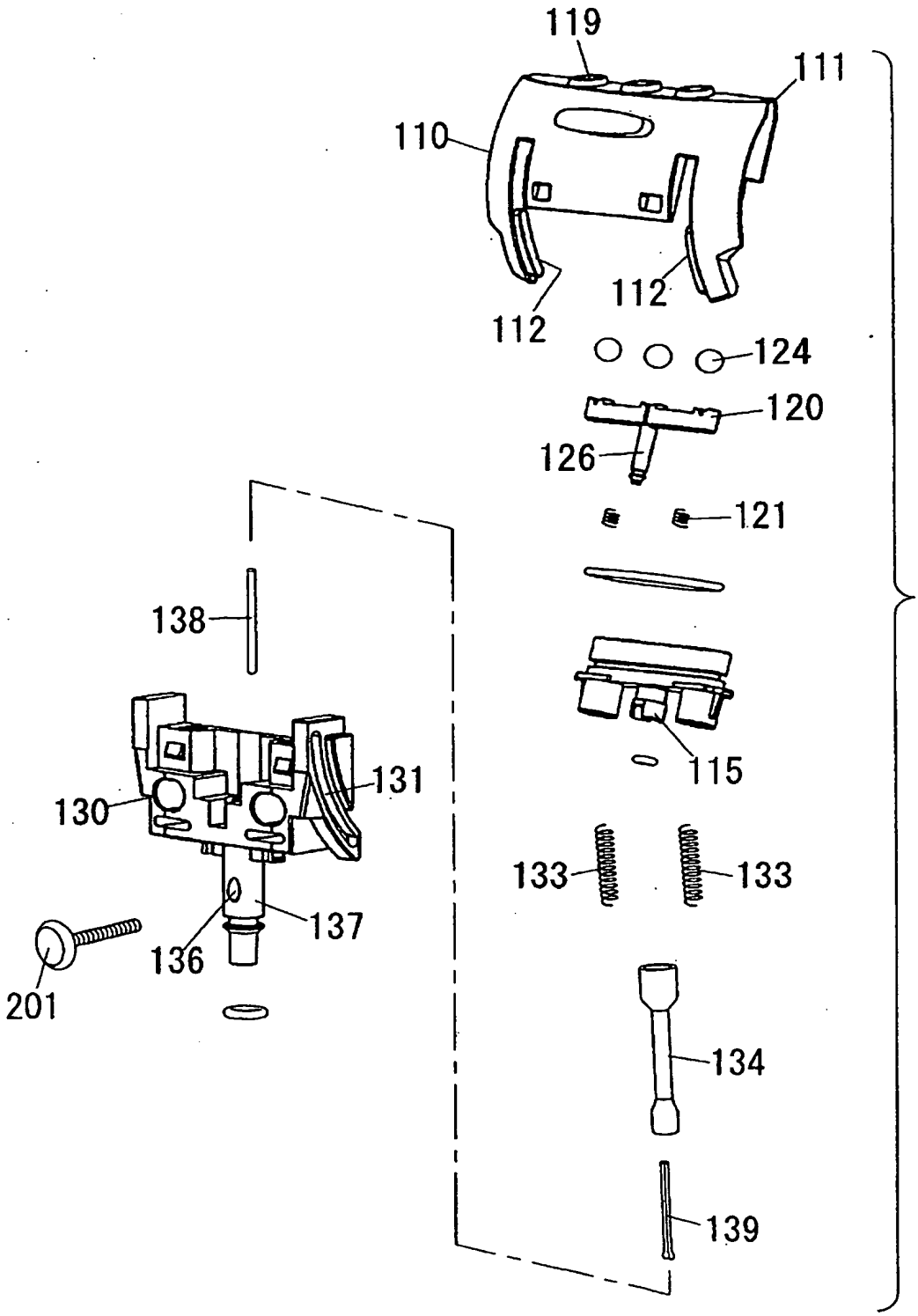

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FIG. 7

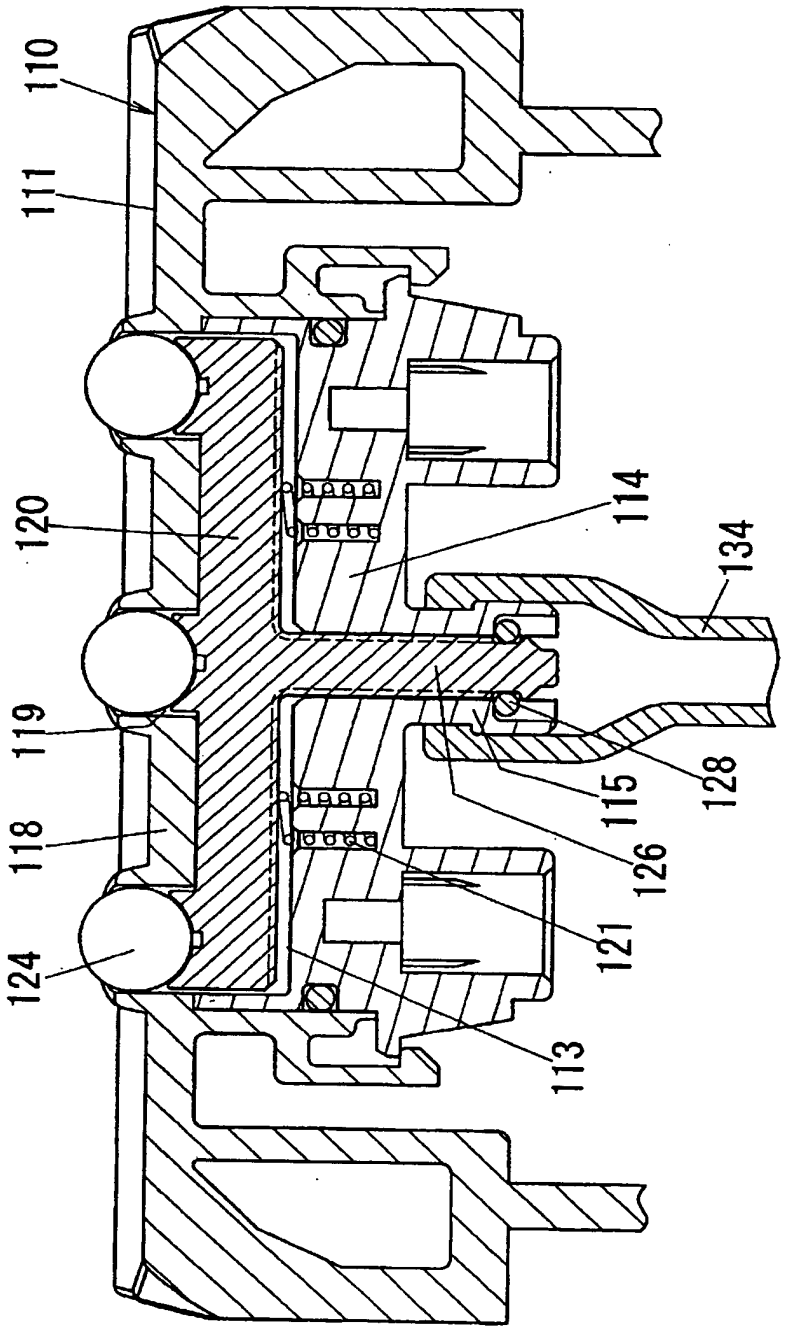

FIG. 8

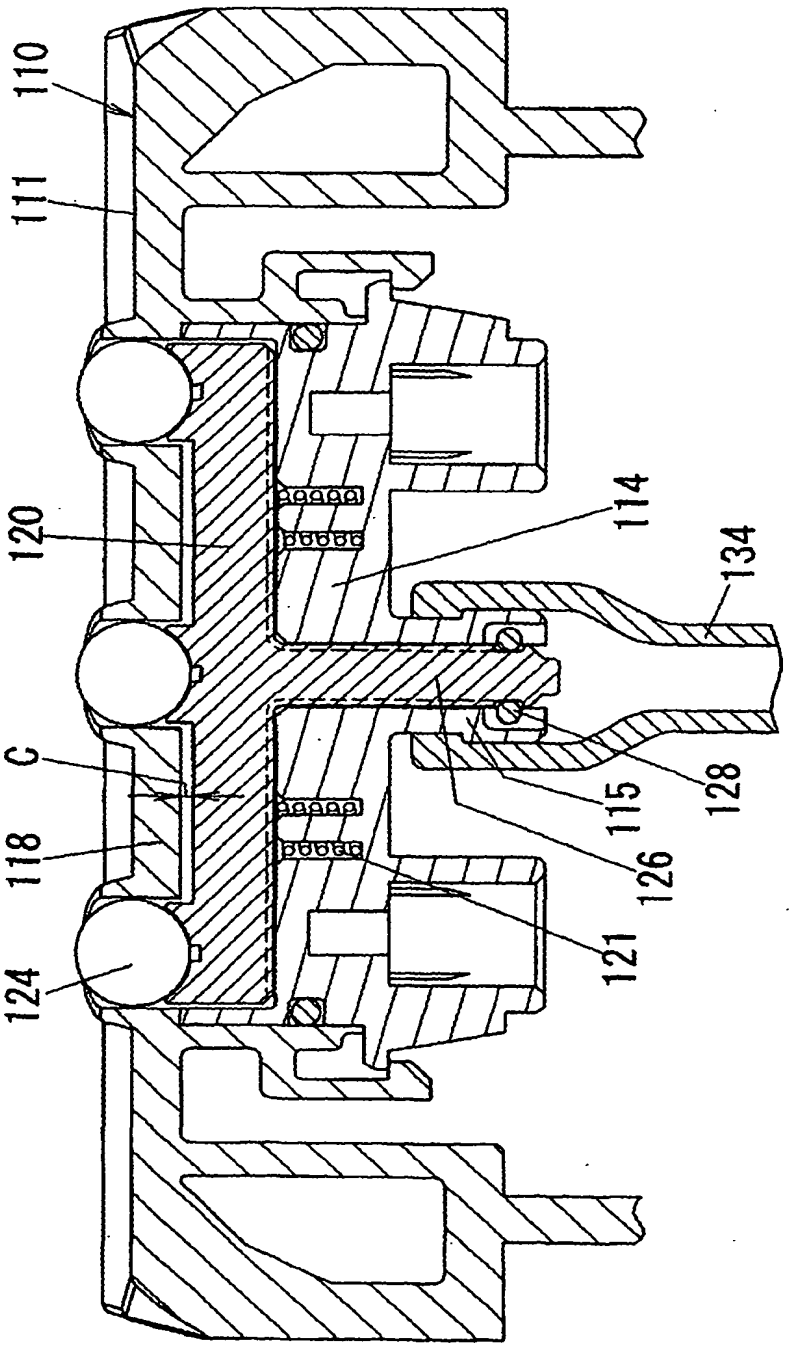

FIG. 9

FIG. 10

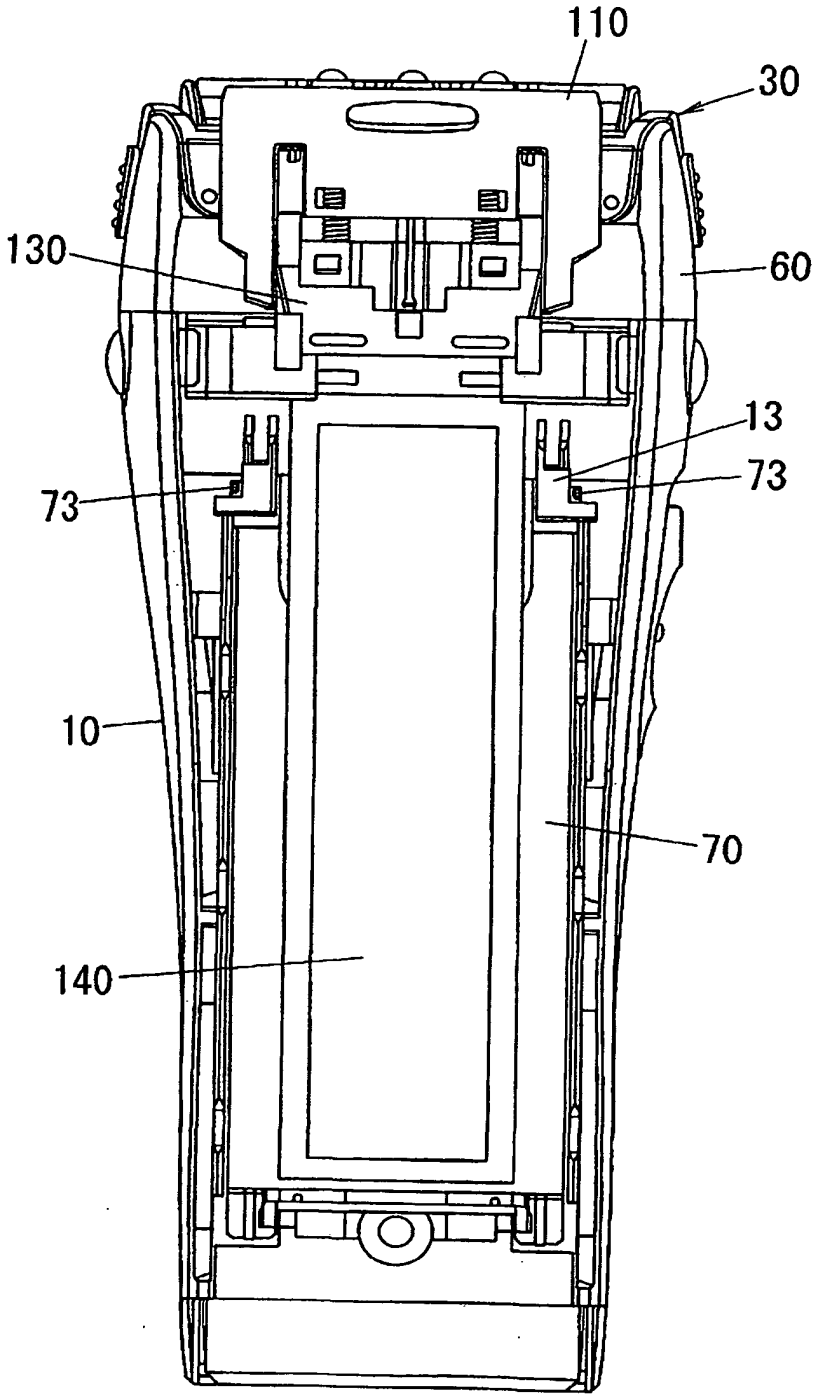

FIG. 11

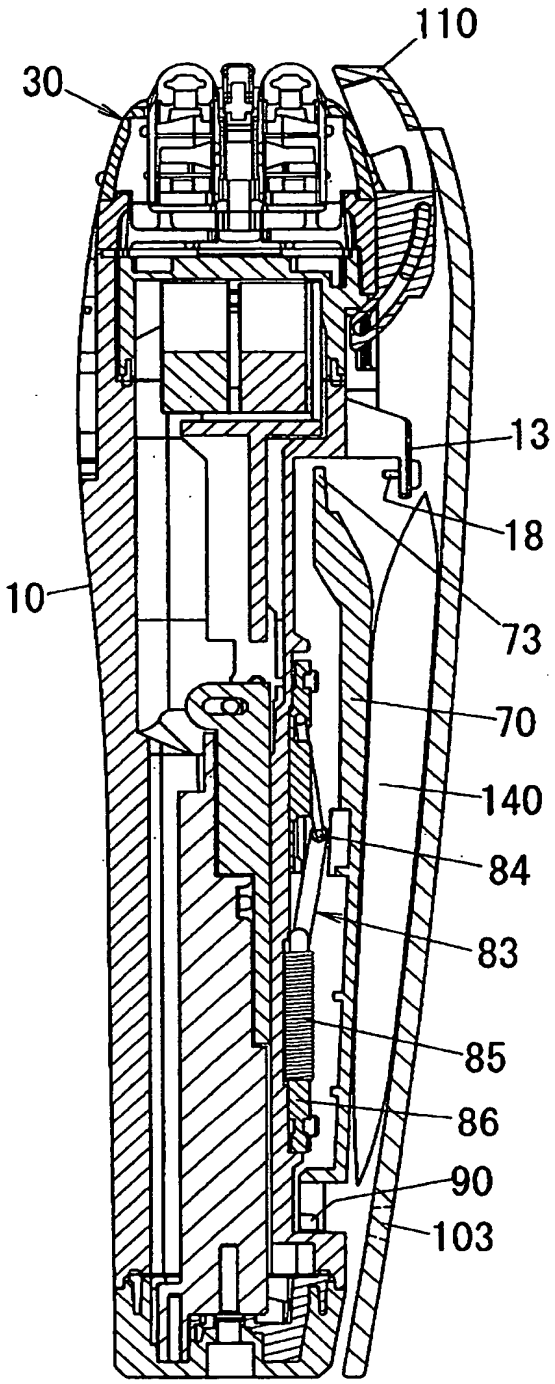
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FIG. 12

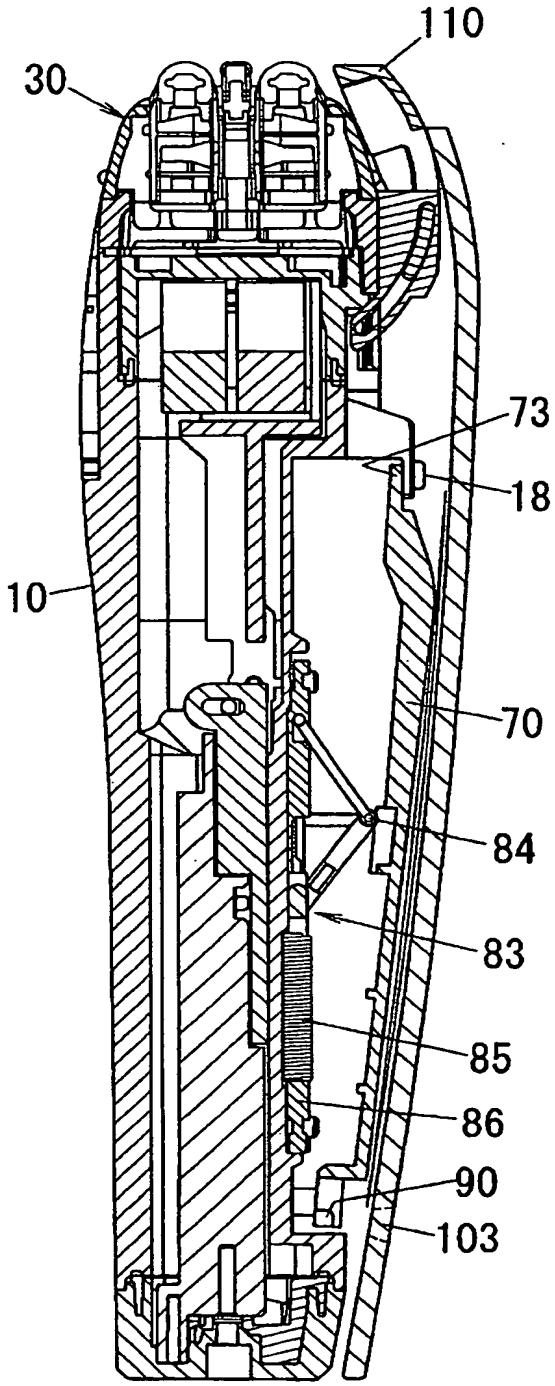
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FIG. 13

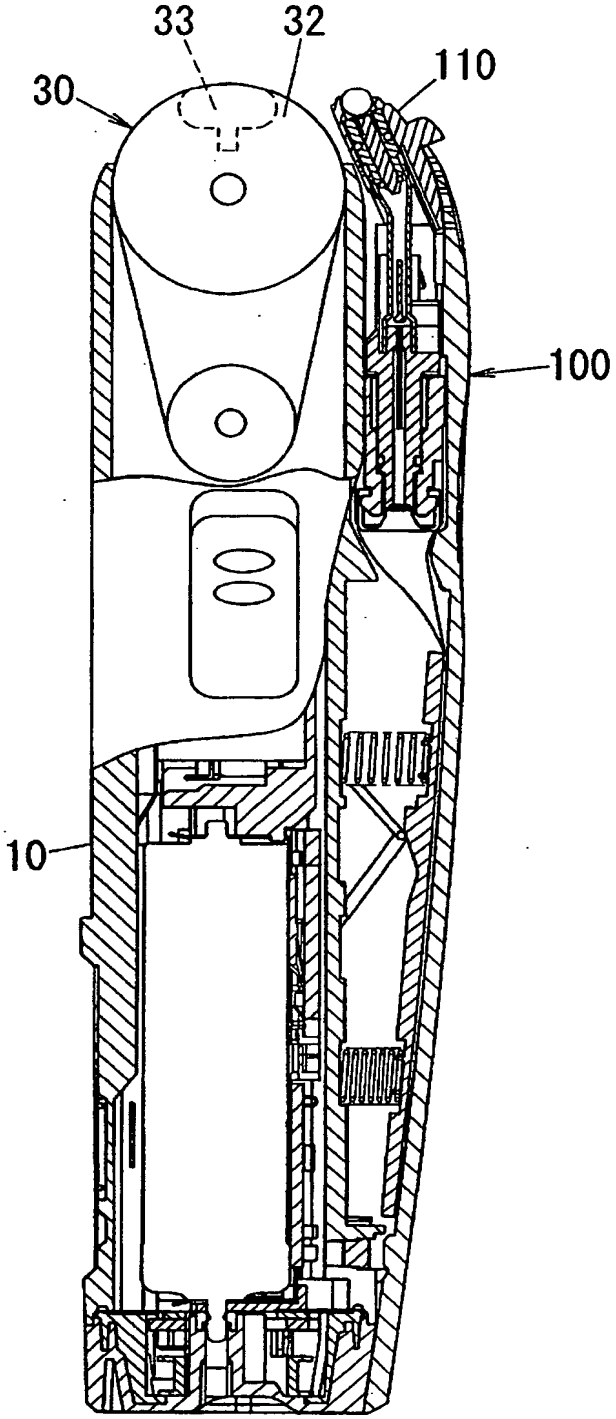

FIG. 14

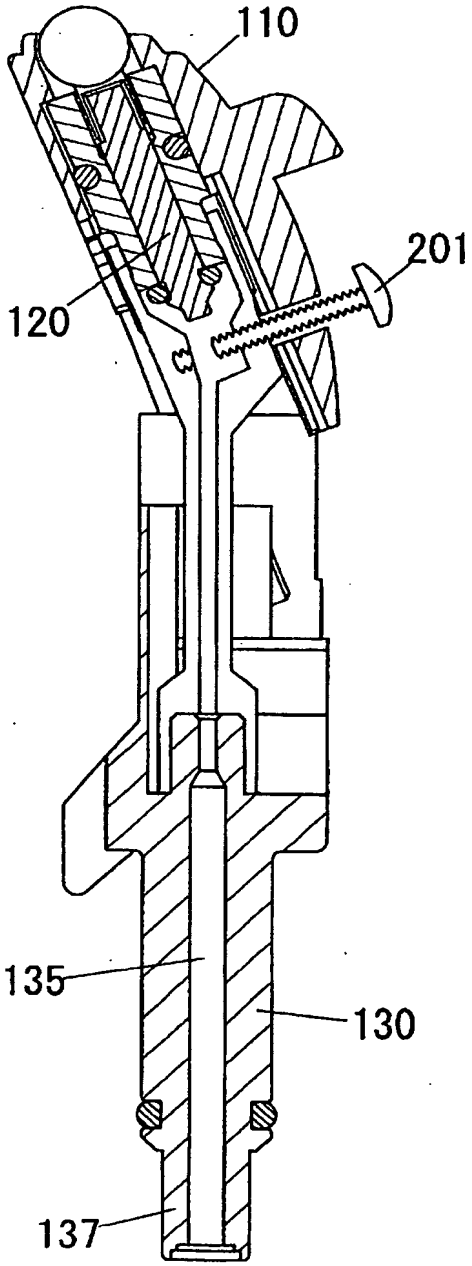

FIG. 15

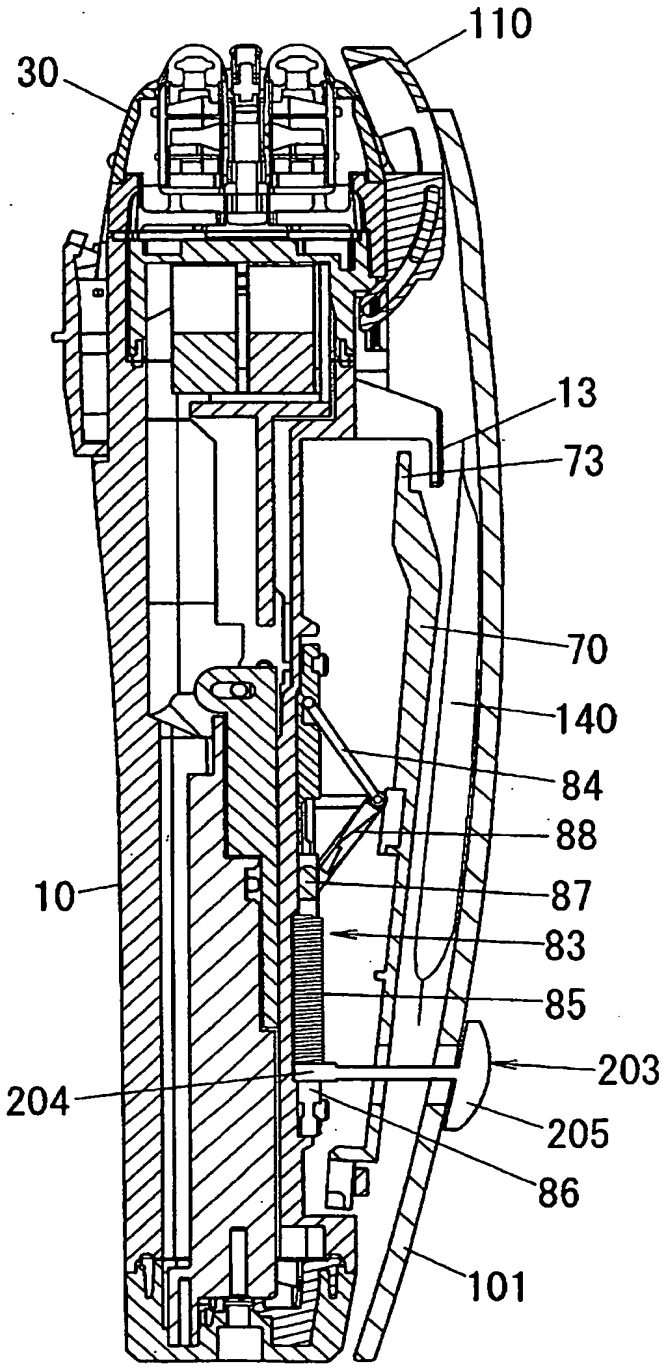

FIG. 16

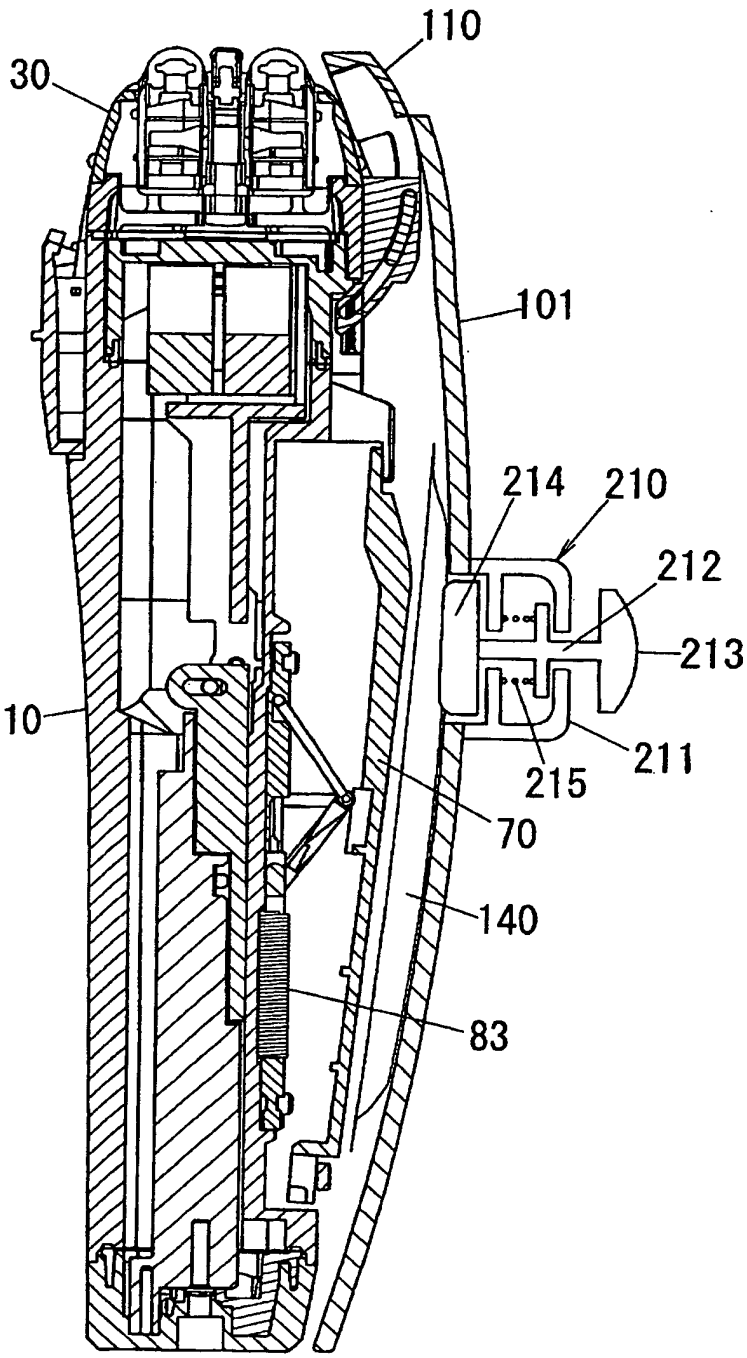

FIG. 17

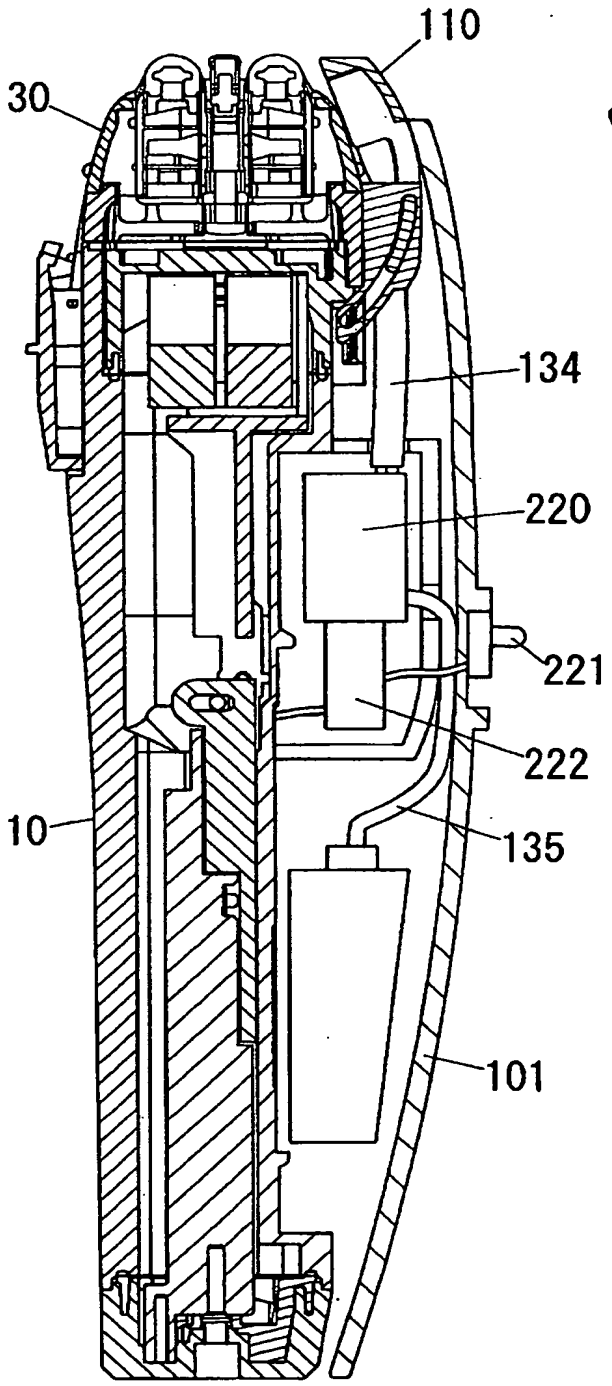
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FIG. 18

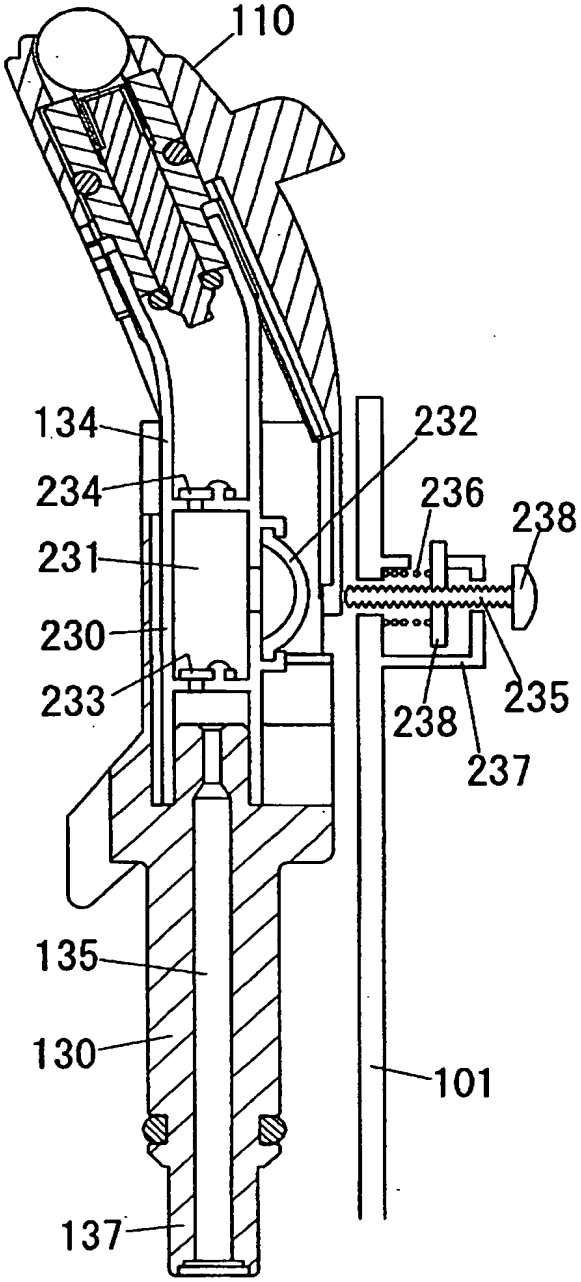
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FIG. 19

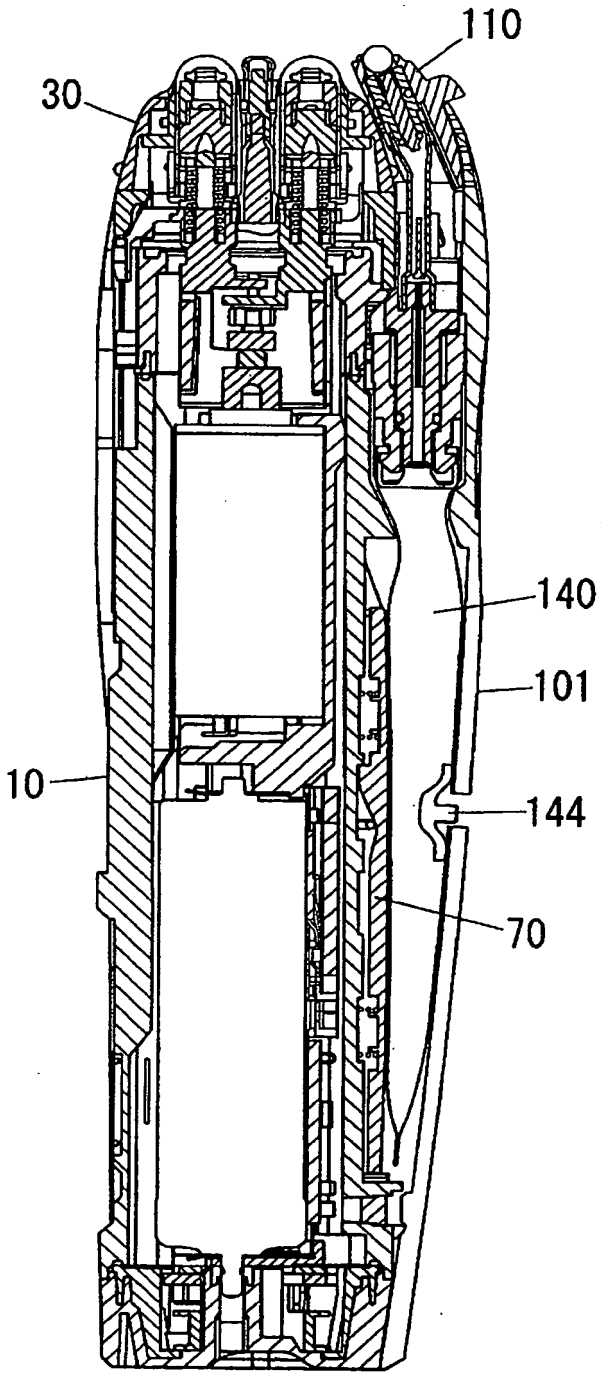

FIG. 20C

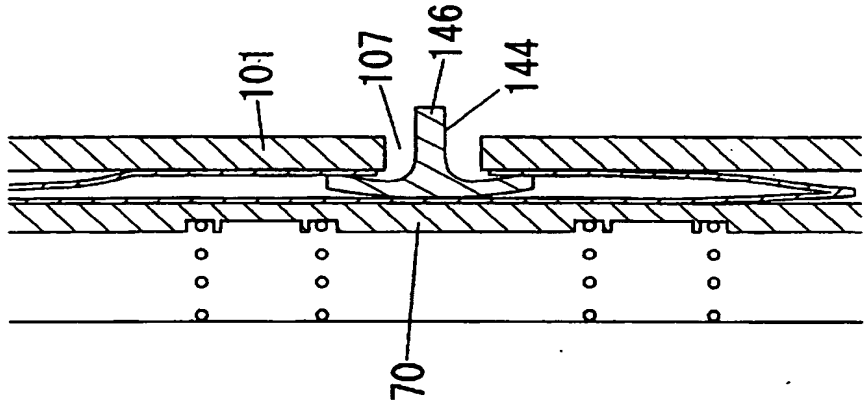

FIG. 20B

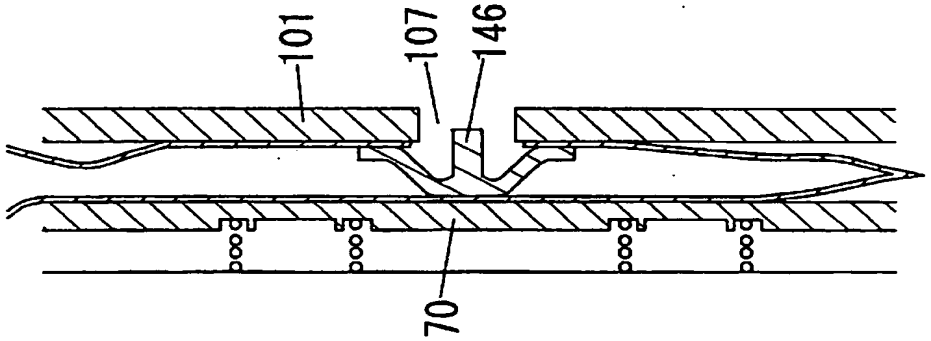

FIG. 20A

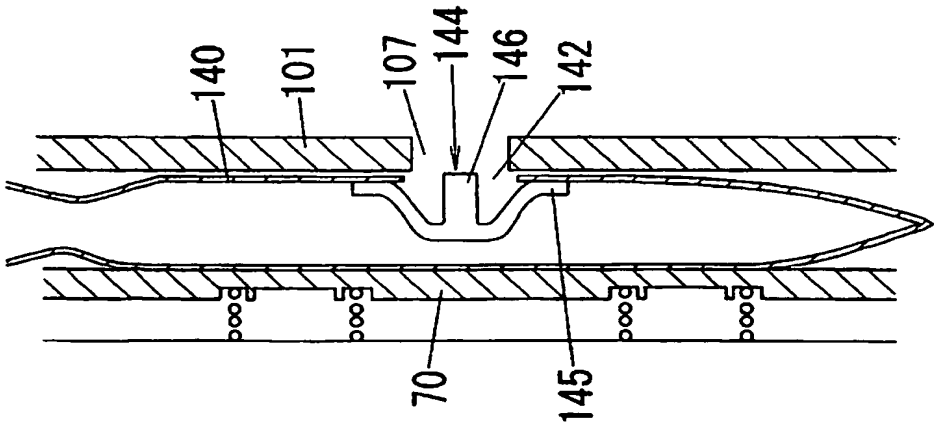

FIG. 21

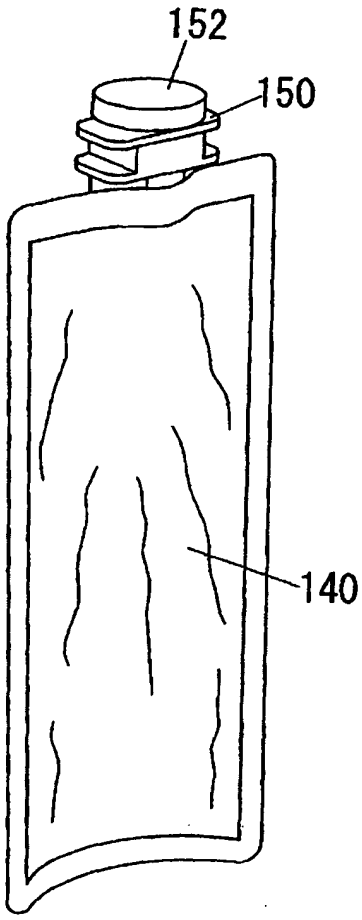

FIG. 22

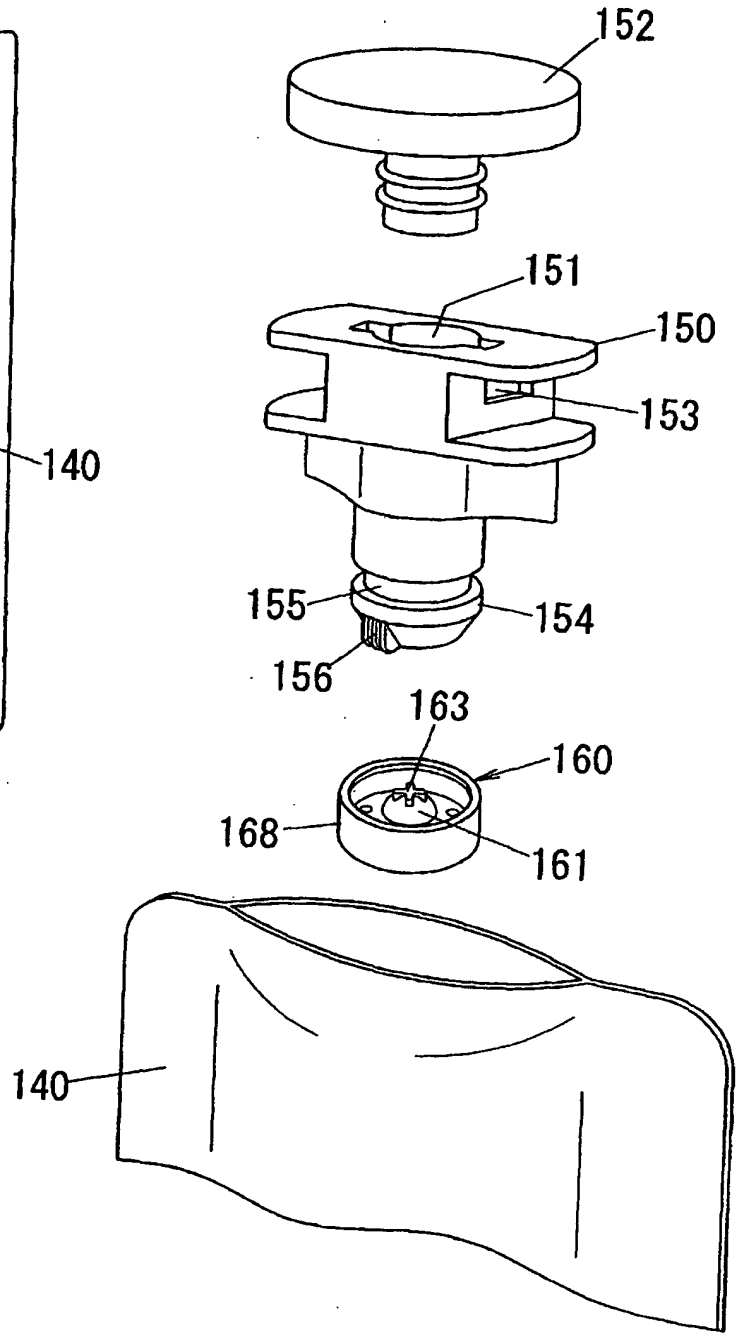

FIG. 23

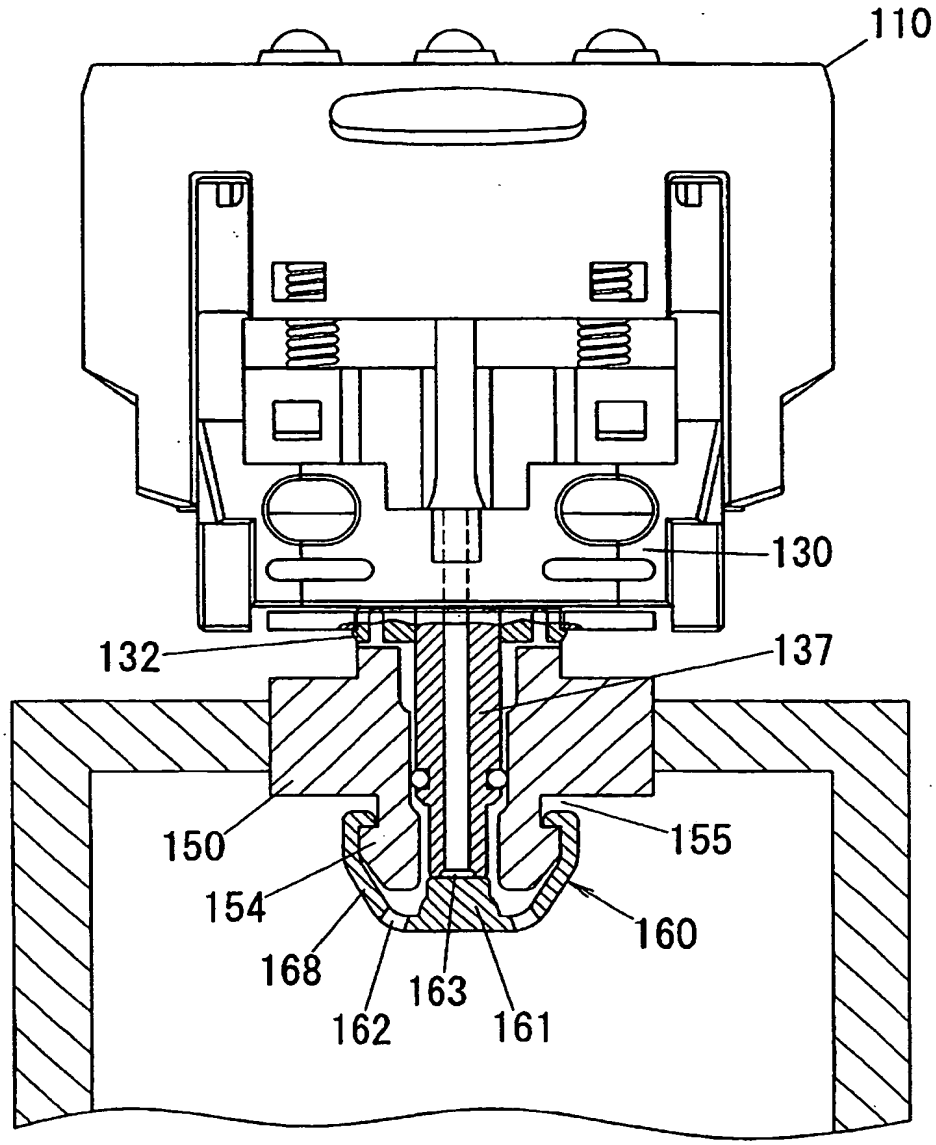

FIG. 24

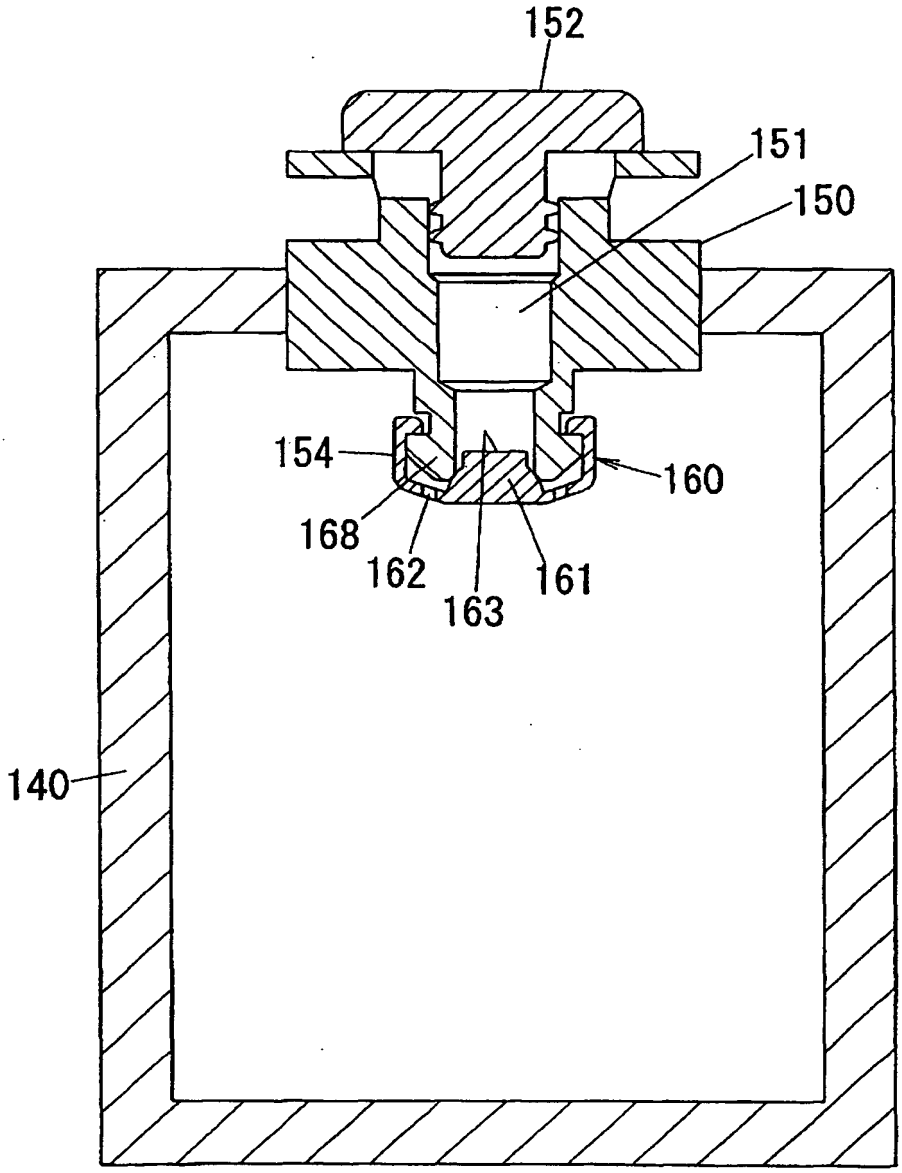

FIG. 25

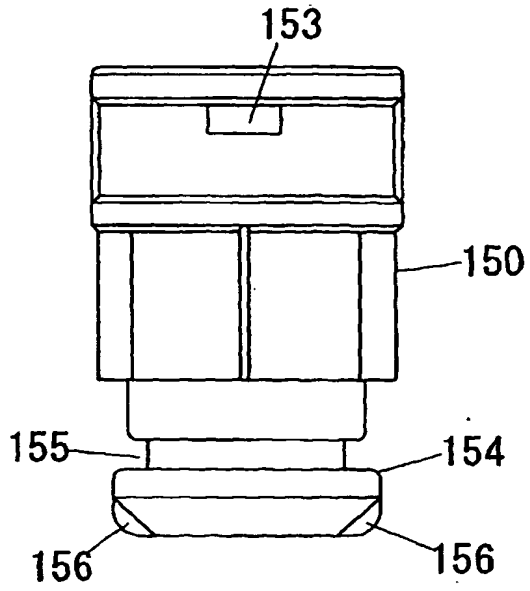

FIG. 26

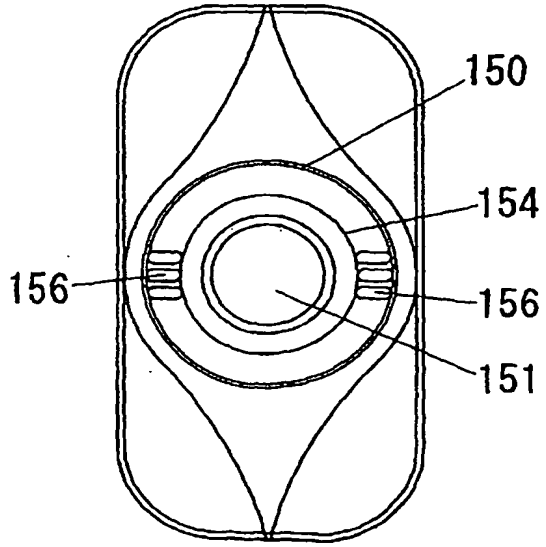

FIG. 27

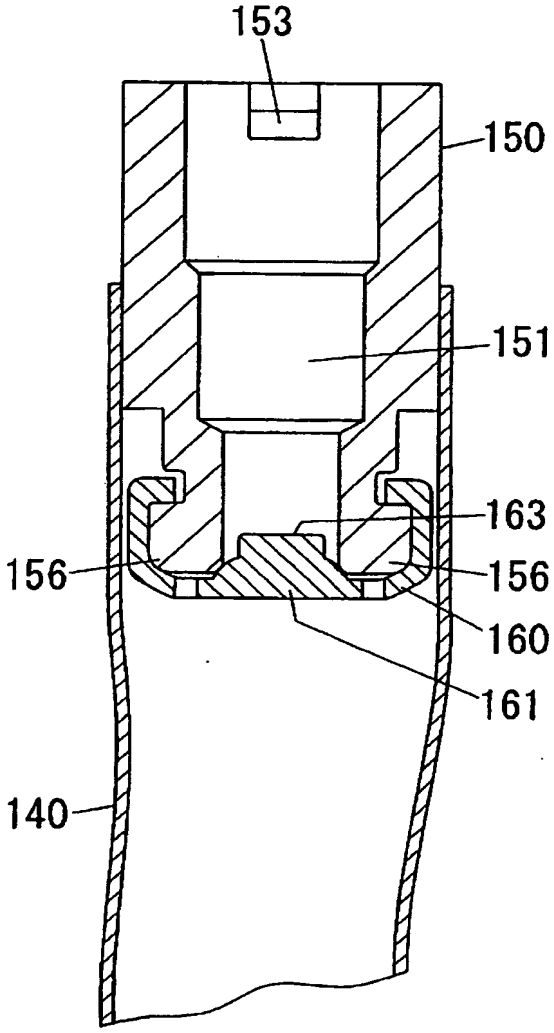
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FIG. 28

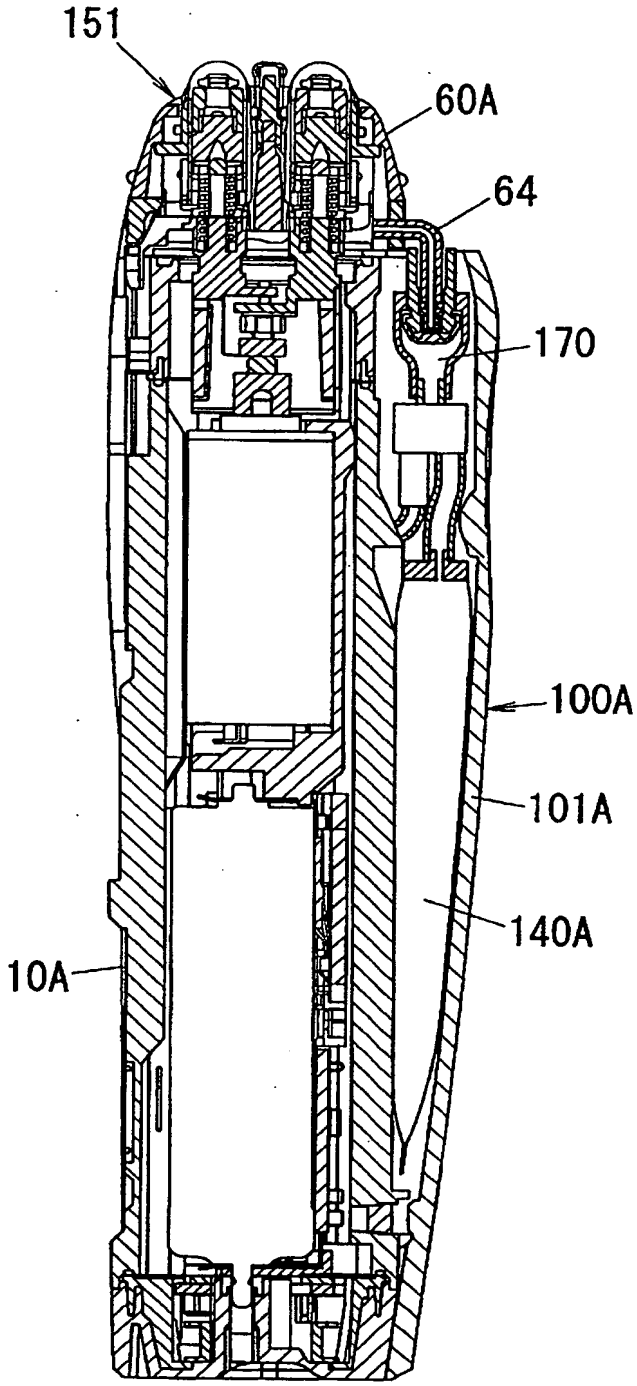
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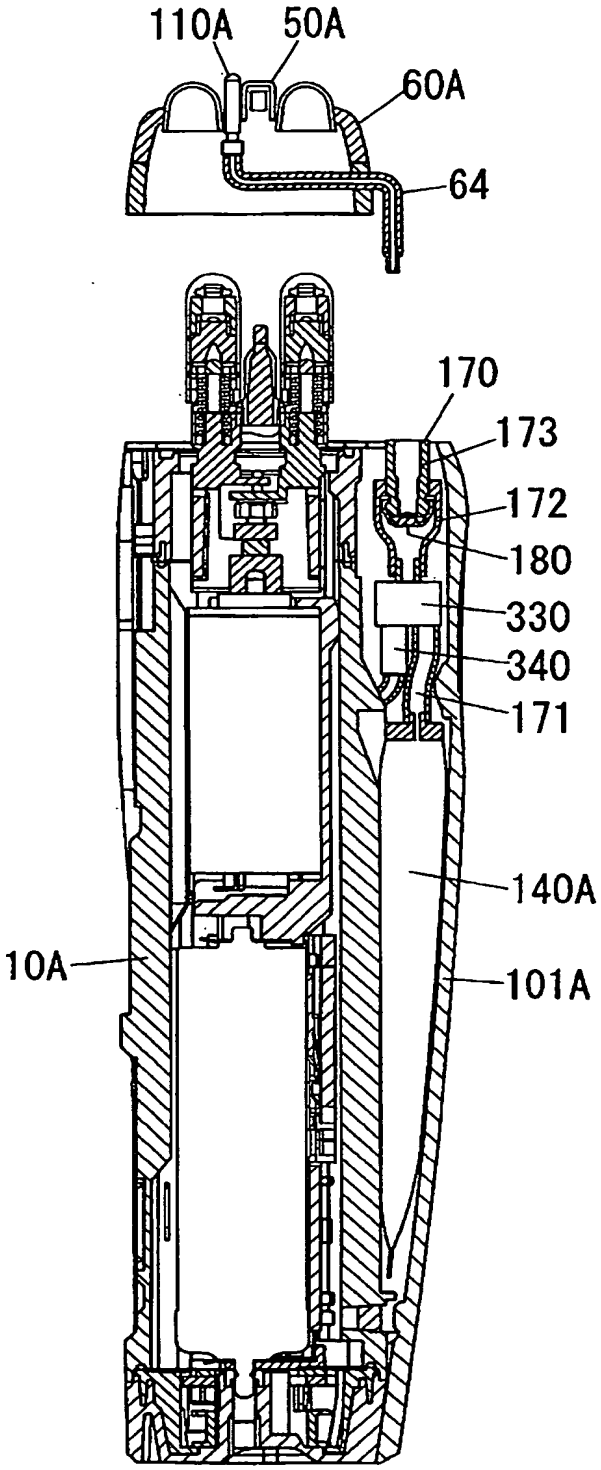
FIG. 29



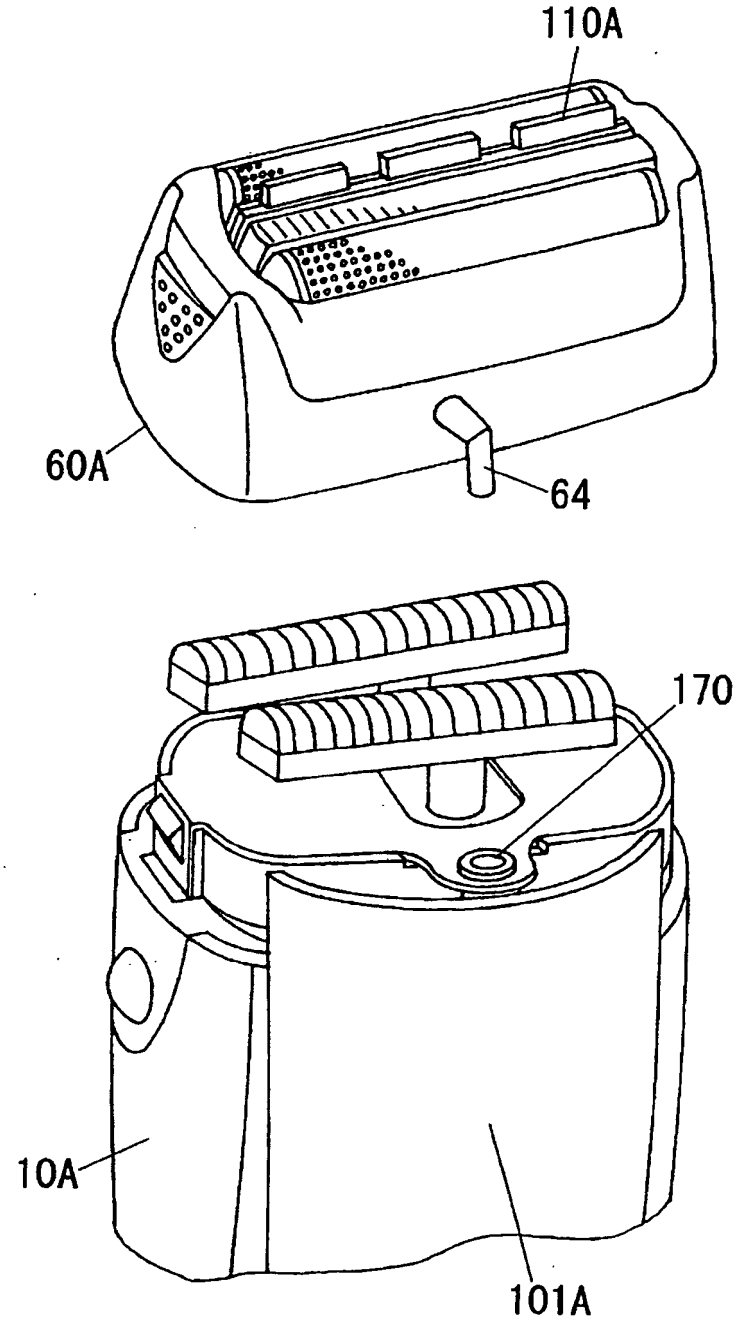


FIG. 30

FIG. 31

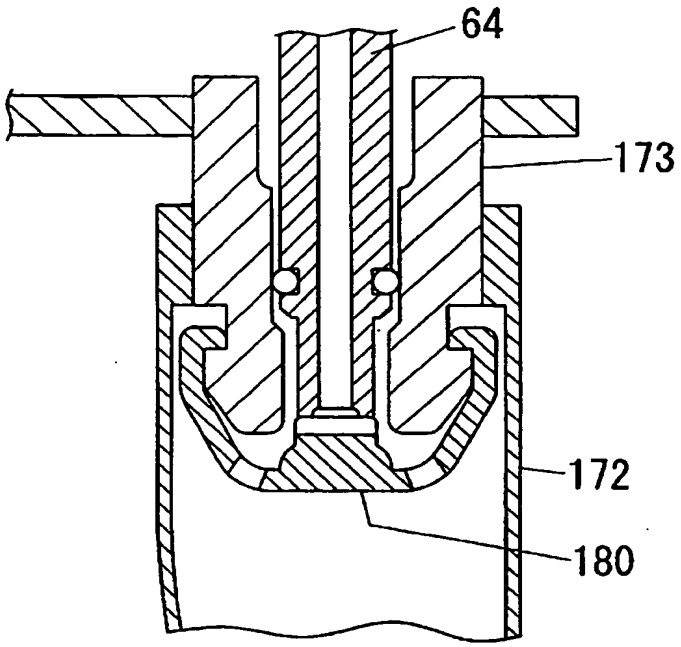


FIG. 32

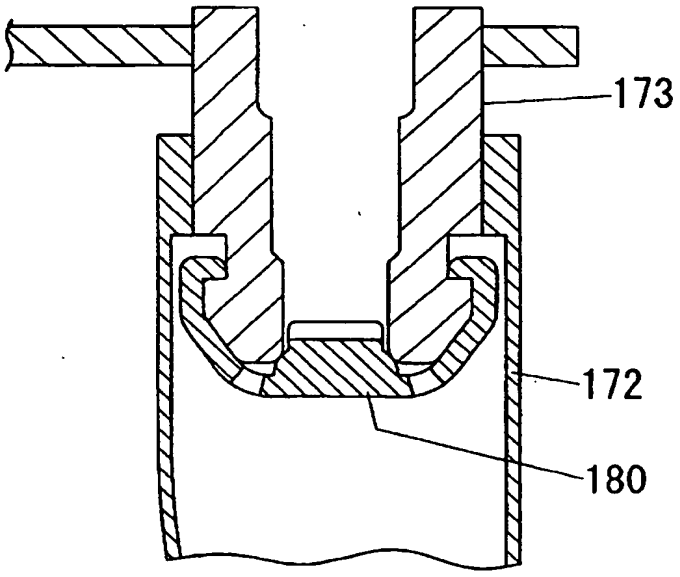
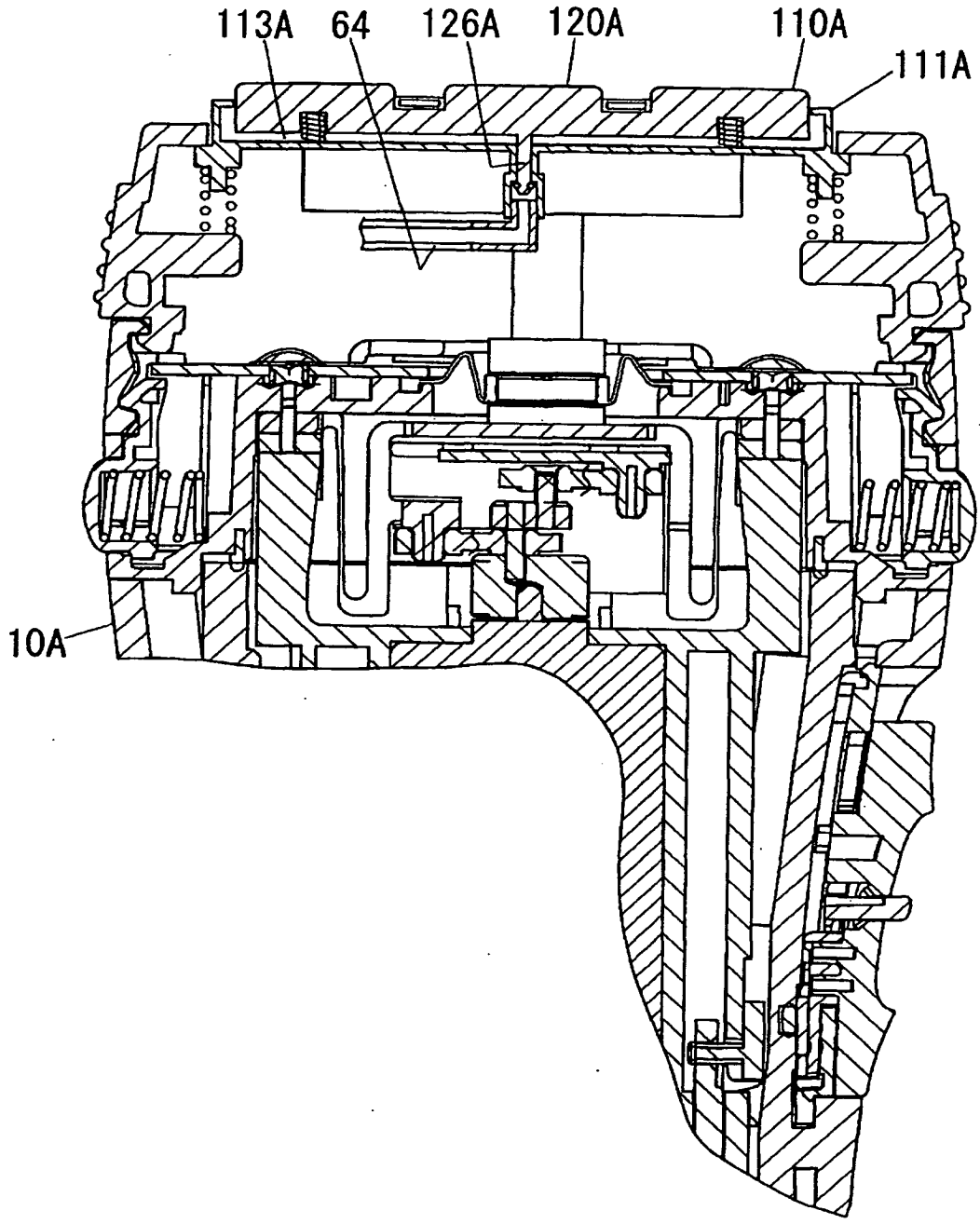


FIG. 33



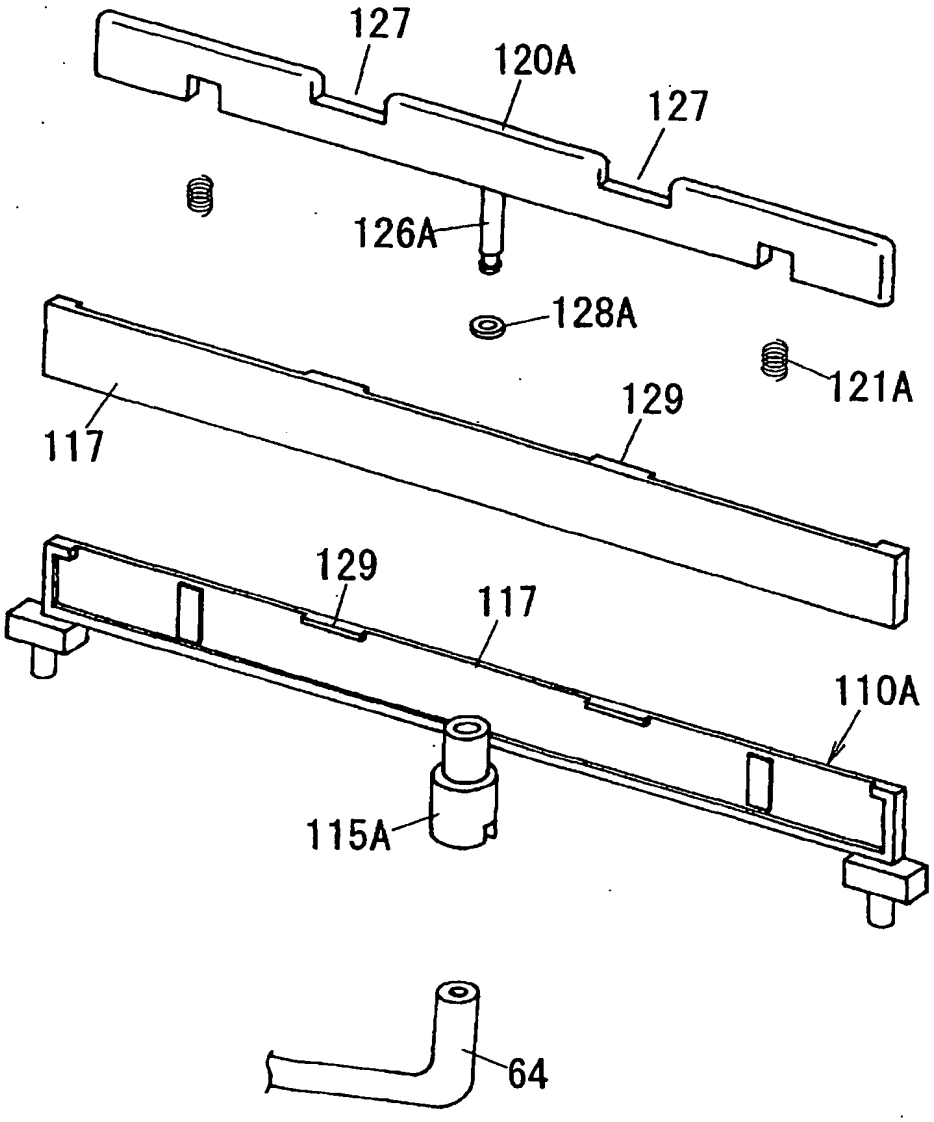


FIG. 34

FIG. 35A

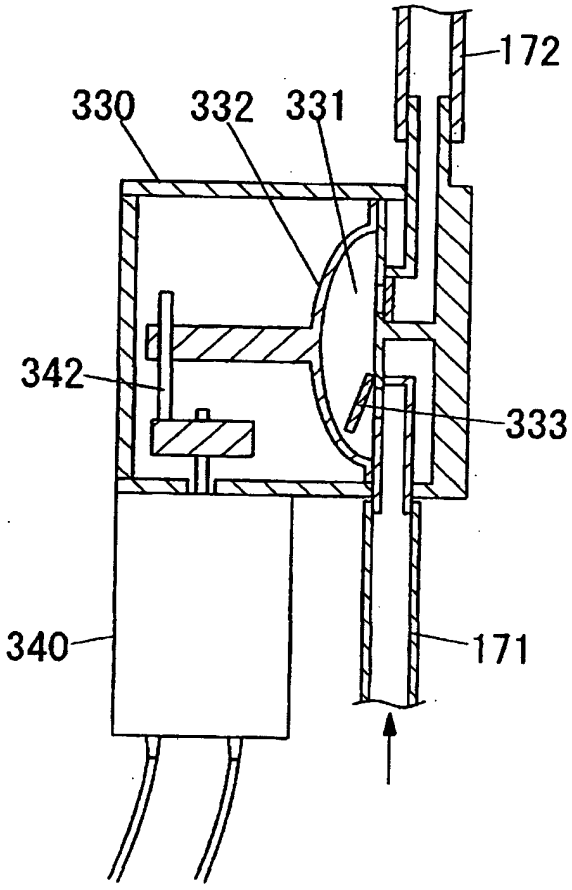


FIG. 35B

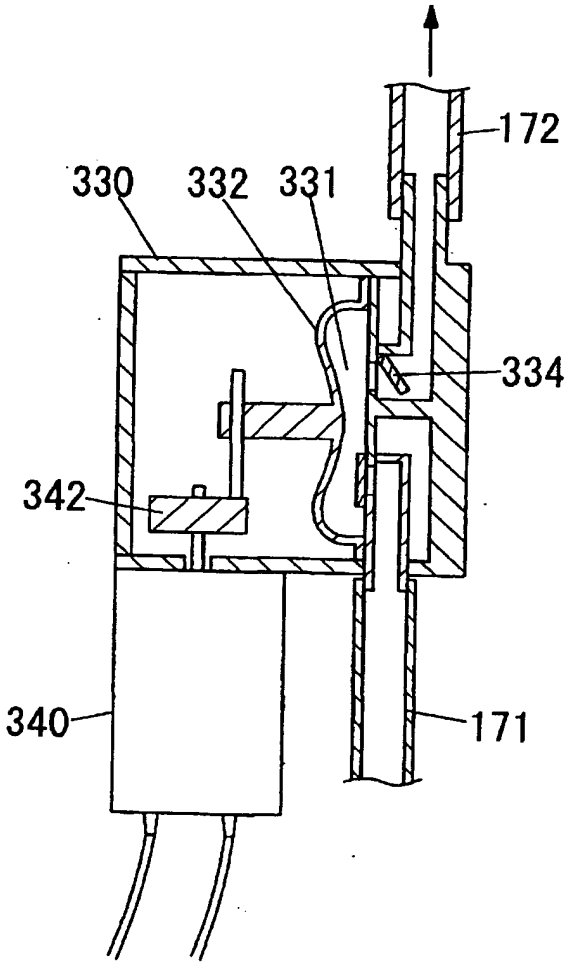


FIG. 36

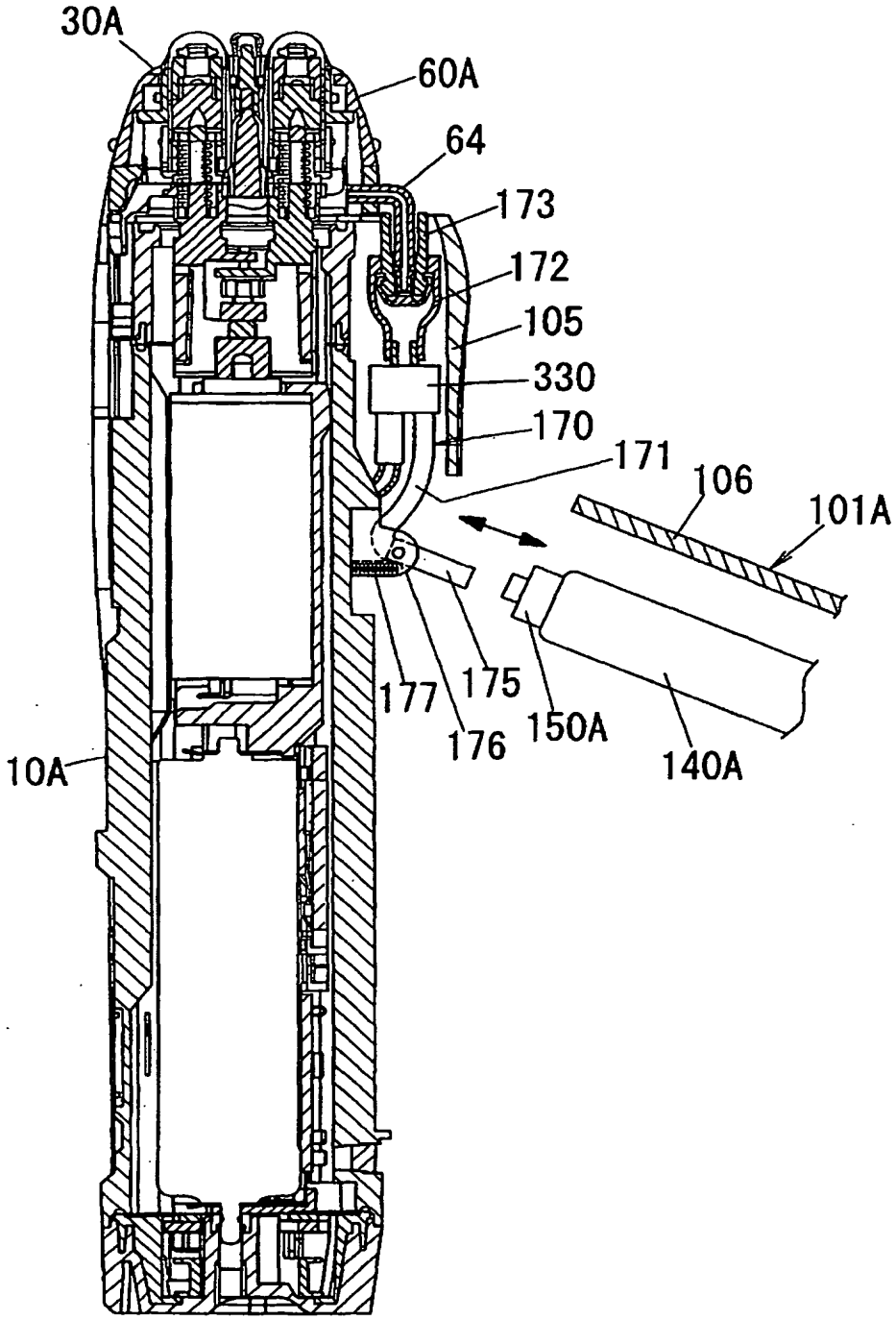

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FIG. 37

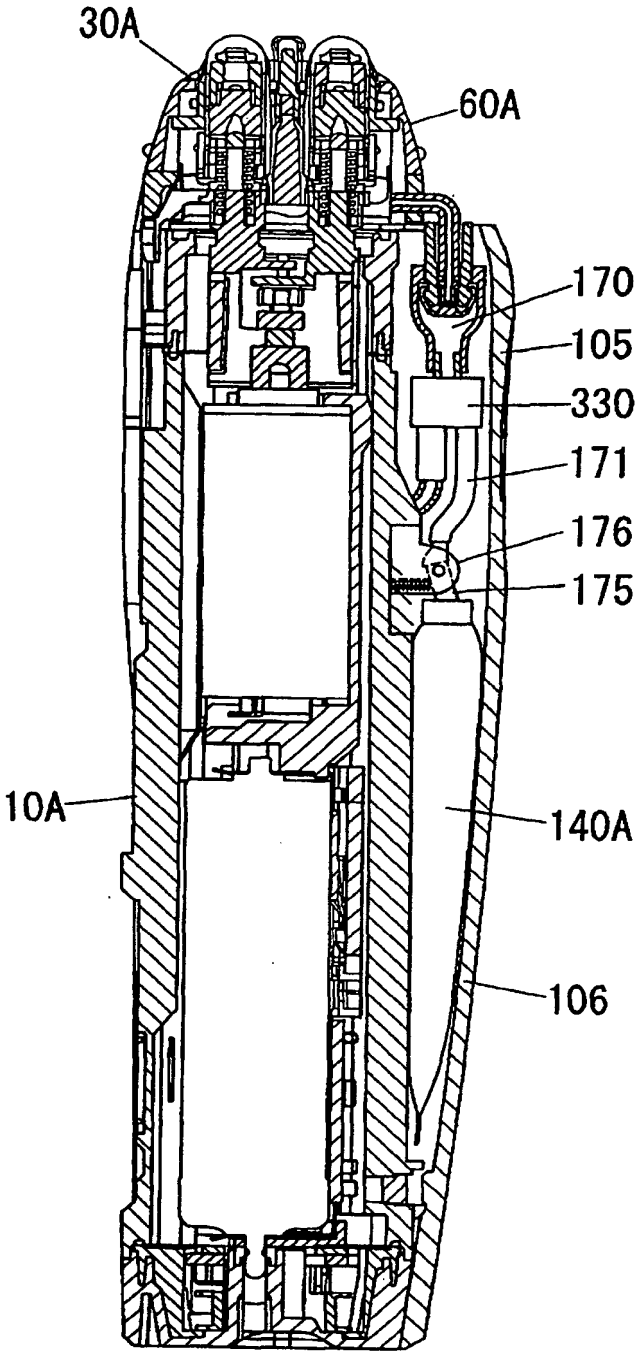

FIG. 38

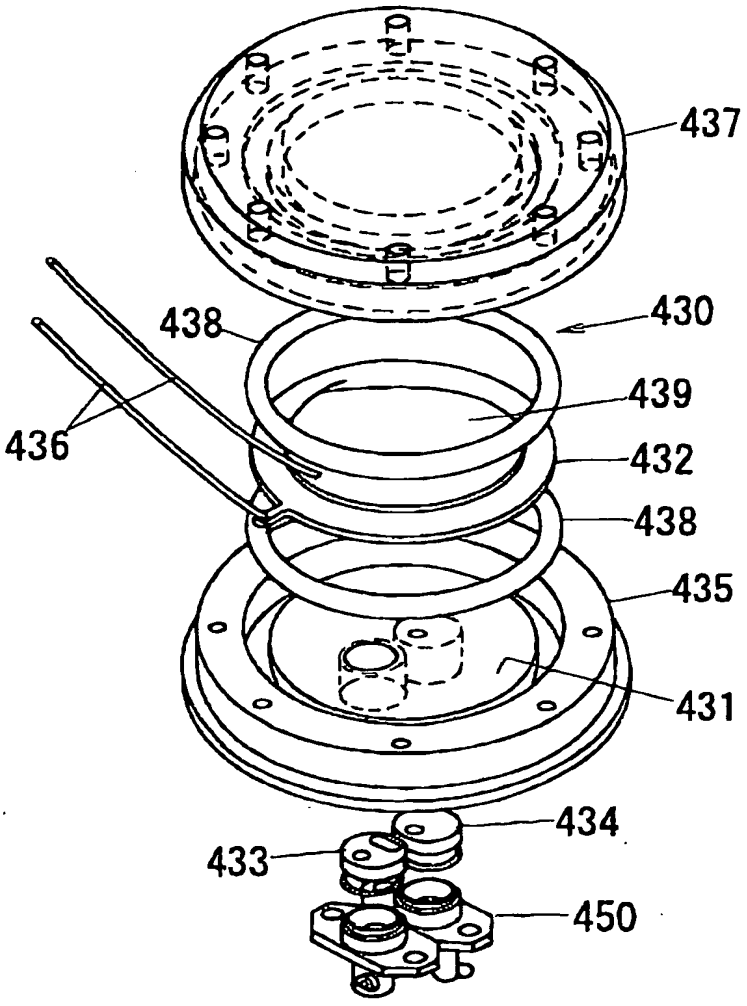

FIG. 39

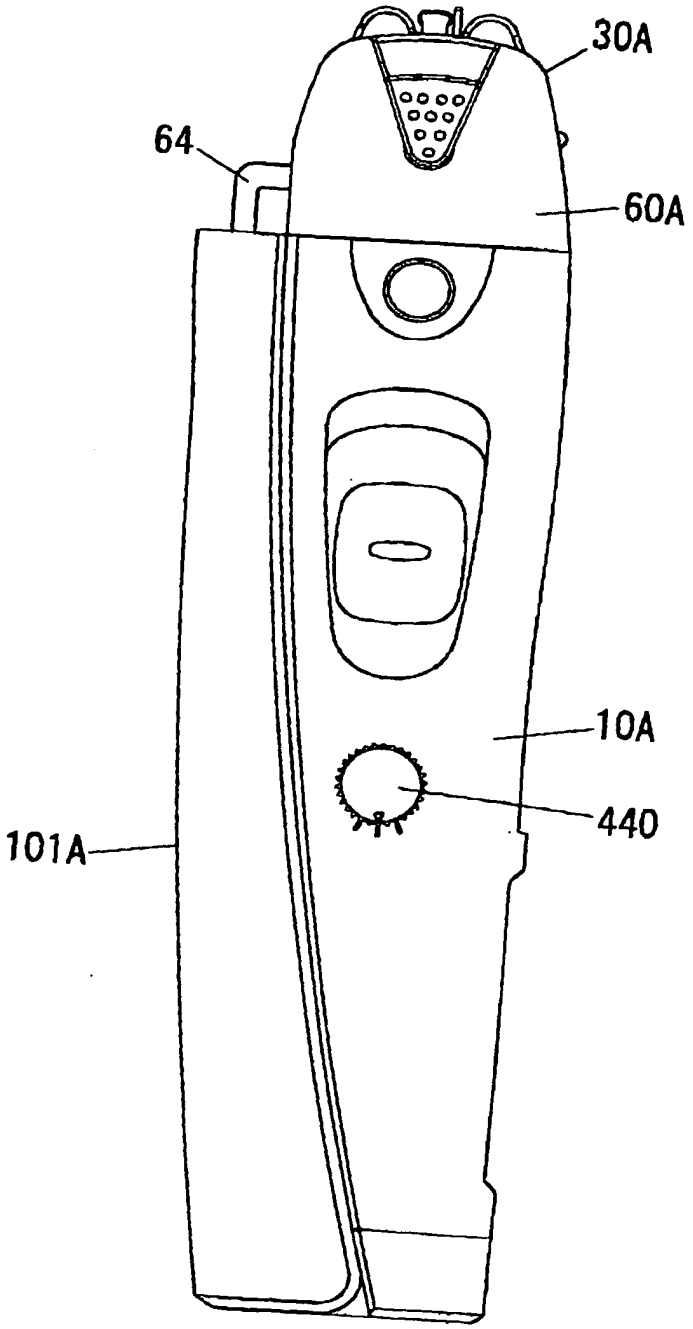

FIG. 40

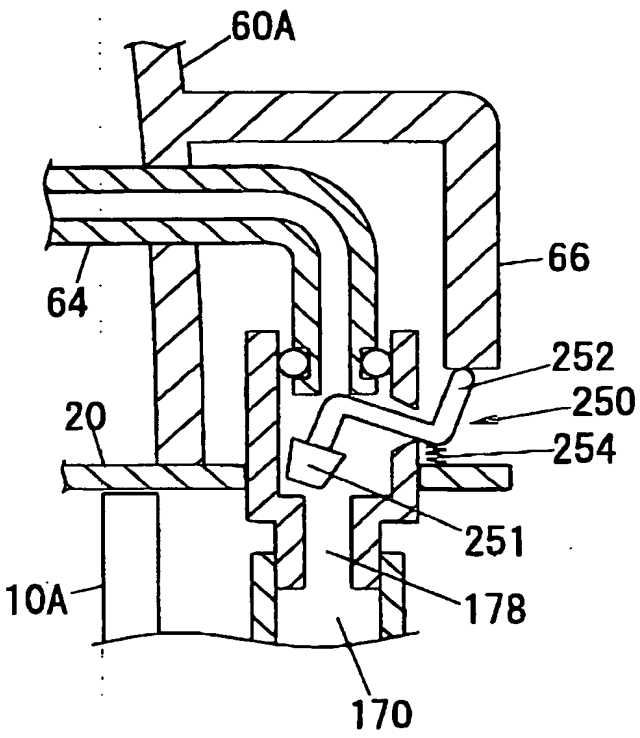
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FIG. 41

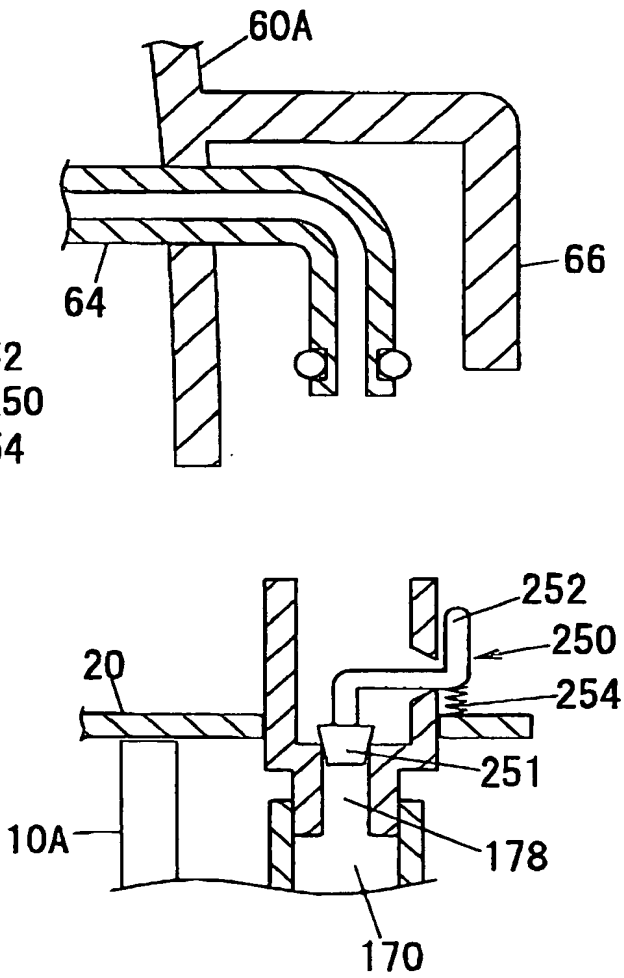
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FIG. 42

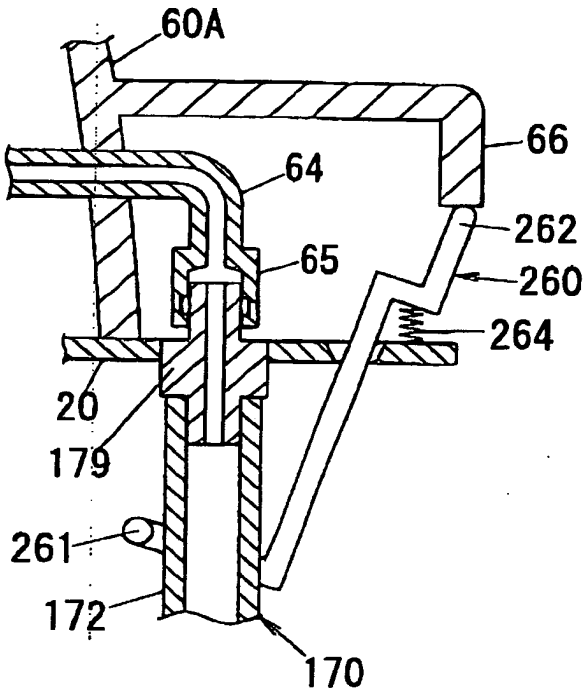
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FIG. 43

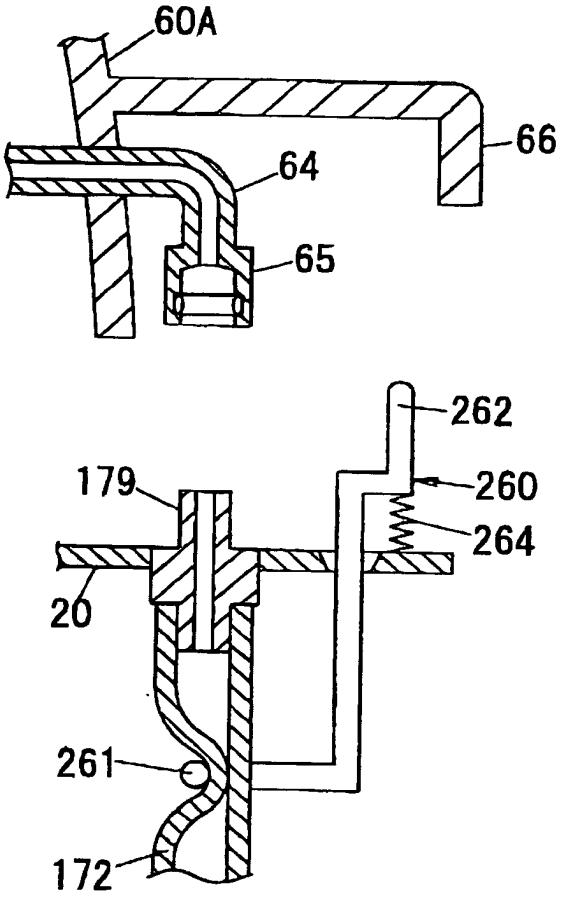
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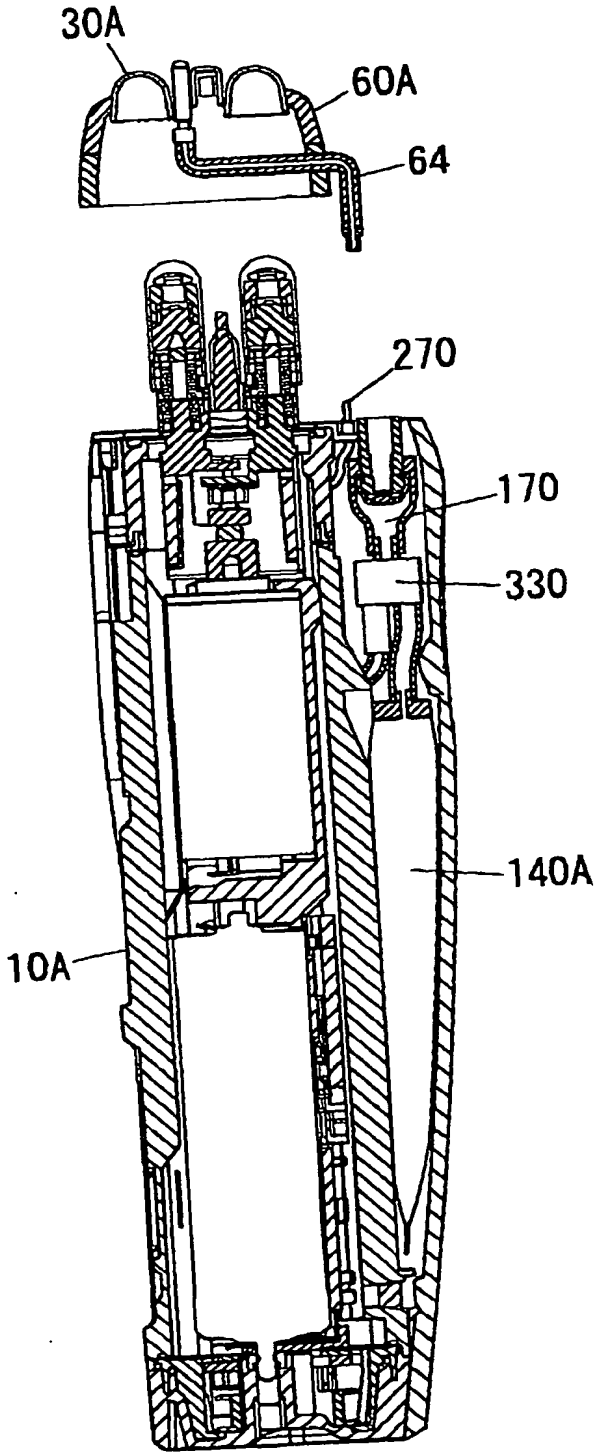
FIG. 44



INTERNATIONAL SEARCH REPORT

International Application No
PCT/JP 03/01427

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B26B19/40 A45D26/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 B26B A45D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
PAJ, EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 635 361 A (DEMARS ROBERT) 13 January 1987 (1987-01-13) column 2, line 34 -column 3, line 50; figures 1-3	1-3,8,24
X	US 2002/004986 A1 (HACZEK WERNER ET AL) 17 January 2002 (2002-01-17) paragraphs '0005!,'0030!-'0056!; figures 1-11	1,8
X	US 6 312 436 B1 (RIJKEN MARTINUS M ET AL) 6 November 2001 (2001-11-06) column 3, line 59 -column 6, line 41; figures 1-7	1,8

-/--

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
8 May 2003	19/05/2003

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Maier, M

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

International Application No
PCT/JP 03/01427

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
X	US 3 176 392 A (GWINN ROBERT P) 6 April 1965 (1965-04-06) column 2, line 36 -column 7, line 28; figures 1-8	1,8
A	US 3 846 326 A (WRIGHT D ET AL) 5 November 1974 (1974-11-05) the whole document	1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/JP 03/01427

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